

The Polis Center
IUPUI
1200 Waterway Boulevard
Suite 100
Indianapolis, IN 46202

Southern Five Regional
Planning District and
Development Commission
219 Rustic Campus Drive
Ullin, IL 62992



Southern Illinois University
Carbondale
Department of Geology
206 Parkinson Laboratory
Carbondale, IL 62901

Hazard Mitigation Plan

Union County, Illinois

Adoption Date: -- _____ --

Primary Point of Contact

Dana Pearson
Union County ESDA Director
301-1 West Mississippi Street
Jonesboro, IL 62952
(618)697-0760

Secondary Point of Contact

Crystal Davenport
Southern Five Regional Planning District and Development Commission
(618) 634-2284
cdaven@southernfive.org

Prepared by:

Southern Five Regional Planning District and Development Commission
219 Rustic Campus Drive
Ullin, IL 62992
(618) 634-2284

Department of Geology
Southern Illinois University
Carbondale, Illinois 62901
(618) 453-7370

The Polis Center
1200 Waterway Boulevard, Suite 100
Indianapolis, IN 46202
(317) 274-2455

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Section 1 - Public Planning Process

1.1 Narrative Description

Hazard Mitigation is defined as any sustained action to reduce or eliminate long-term risk to human life and property from hazards. The Federal Emergency Management Agency (FEMA) has made reducing hazards one of its primary goals; hazard mitigation planning and the subsequent implementation of resulting projects, measures, and policies is a primary mechanism in achieving FEMA's goal.

The Multi-Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The development of a local government plan is a requirement in order to maintain eligibility for certain federal disaster assistance and hazard mitigation funding programs. In order for the National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt an MHMP.

In recognition of the importance of planning in mitigation activities, FEMA has created HAZUS-MH (**H**azards **U**SA **M**ulti-**H**azard) a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to predict the estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. The Illinois Emergency Management Agency (IEMA) has determined that HAZUS-MH should play a critical role in the risk assessments in Illinois. Southern Illinois University at Carbondale (SIUC) and The Polis Center at Indiana University Purdue University Indianapolis (IUPUI) are assisting Union County planning staff with performing the hazard risk assessment.

1.2 Planning Team Information

The Union County Multi-Hazard Mitigation Planning Team is headed by Dana Pearson, whom is the primary point of contact. Members of the planning team including jurisdictions within the county and state representatives. Table 1-1 below identifies the planning team individuals and the organizations they represent.

Table 1-1: Multi-Hazard Mitigation Planning Team Members

Name	Title	Organization	Jurisdiction
David Livesay	Sheriff	County of Union	Union County
Dana Pearson	ESDA	Union County Emergency Management	Union County
Mike Yates	Forman	Union Co. Highway	Union County
Jana Fear	Coordinator	911	Union County
Todd Harris	Chief	Wolf Lake F.D.	Union County
Bill Jackson	Private Citizen		Anna

Name	Title	Organization	Jurisdiction
Mike Stoner	Fire Fighter	Anna F.D.	Anna
Al Kamp	Sergeant	Anna P.D.	Anna
Jimmy Watkins	Councilman	City of Jonesboro	Jonesboro
Bill Ecker	Councilman	City of Jonesboro	Jonesboro
Crystal Gurley	Assistant 911 Director	Alto Pass F.D.	Alto Pass
Donald Rehmer	Mayor	Alto Pass	Alto Pass
Alan Eddington	Board Member	Village of Cobden	Cobden
Larry Nace	Superintendent	Village of Cobden	Cobden
Dale Aden	Board Member	Village of Dongola	Dongola
Scott Crist	District Fire Management Officer	U.S. Forest Service	Federal

The Disaster Mitigation Act (DMA) planning regulations and guidance stress that planning team members must be active participants. The Union County MHMP committee members were actively involved on the following components:

- Attending the MHMP meetings
- Providing available Geographic Information System (GIS) data and historical hazard information
- Reviewing and providing comments on the draft plans
- Coordinating and participating in the public input process
- Coordinating the formal adoption of the plan by the county

An MHMP kickoff meeting was held at the Shawnee Community College in Ullin, IL on April 14th, 2008. Representatives of Union County attended the meeting. Lisa Thurston Director of Southern Five Regional Planning District and Development Commission explained the rationale behind the MHMP program and answered questions from the participants. Nicholas Pinter from SIU, provided an introduction to hazards, and John Buechler, from The Polis Center, provided an overview of HAZUS-MH. Nicholas described the timeline and the process of the mitigation planning project and presented Union County with a Memorandum of Understanding (MOU) for sharing data and information.

The Union County Multi-Hazard Mitigation Planning Team met on October 28, 2008, December 10, 2008, June 8, 2009, September 22, 2009, and March 9, 2010. Meeting one and two were held at the Brick House Restaurant in Anna. Meeting 3 was held at the Sunshine Inn Senior's Center in Anna, IL. Meeting four and five were held at the Anna City Hall Meeting Room. Each meeting was approximately two hours in length. The meeting minutes and attendance sheets are

included in Appendix A. During these meetings, the planning team successfully identified critical facilities, reviewed hazard data and maps, identified and assessed the effectiveness of existing mitigation measures, established mitigation projects, and assisted with preparation of the public participation information.

1.3 Public Involvement in Planning Process

The planning process commenced on January 29, 2008 when Southern Illinois University-Carbondale held a news conference to advise the general public that FEMA had approved funding of proposed planning activities for natural disaster preparedness. It was explained that the university would collaborate with members of The Polis Center as well as the five regional planning commissions. The news conference was attended by representatives of the local papers, radio, and television.

Union County conducted presentations for the public to give an overview of the planning process, inform them of the benefits of completing the plan, and discuss natural hazards affecting the county. The public meeting was held on June 8, 2009. Appendix A contains the minutes from the public meeting. Appendix B contains articles published by the local newspaper throughout the public input process.

1.4 Neighboring Community Involvement

The Union County planning team invited participation from various representatives of neighboring counties and local, city, and town governments. The initial planning meeting at SIUC on March 19, 2008 included representatives from the adjacent Southern Five Regional Planning Commission counties of Alexander, Johnson, Massac, Pulaski, and Union. In the meeting, the county board chairmen and their EMA directors discussed creating county planning teams, scheduling meetings throughout the planning process, and ways to ensure public involvement in the plan. The county board chairmen also agreed to allow university research staff to have access to county GIS data from the supervisor of the assessment.

Union County is located along the Mississippi River within southern tip of Illinois and bounded by Jackson County to the north, Williamson County to the northeast, Alexander County to the south, Pulaski County to the southeast, and Johnson County to the East. Union County has working relationships and cooperation with these counties through regional partnerships. Details of how neighboring stakeholders were involved are summarized in Table 1-2.

Table 1-2: Neighboring Community Participation

Person Participating	Neighboring Jurisdiction	Organization	Participation Description
Martha Nicholson	Alexander County	Alexander County Emergency Service and Disaster Agency and 911	Mailed draft copy and asked for suggestions
Derek Misener	Jackson County	Jackson County EMA	Mailed draft copy and asked for suggestions
Jim Haney	Johnson County	Johnson County ESDA	Mailed draft copy and asked for suggestions
Ken Kerley	Pulaski County	Pulaski County ESDA	Mailed draft copy and asked for suggestions
Alan Gower	Williamson County	Williamson County EMA	Mailed draft copy and asked for suggestions

1.5 Review of Technical and Fiscal Resources

The MHMP planning team has identified representatives from key agencies to assist in the planning process. Technical data, reports, and studies were obtained from these agencies. The organizations and their contributions are summarized in Table 1-3.

Table 1-3: Key Agency Resources Provided

Agency Name	Resources Provided
Illinois Environmental Protection Agency	Illinois 2008 Section 303(d) Listed Waters and watershed maps
U.S. Census	County Profile Information such as Population and Physical Characteristics
Department of Commerce and Economic Opportunity	Community Profiles
Illinois Department of Employment Security	Industrial Employment by Sector
NOAA National Climatic Data Center	Climate Data
Illinois Emergency Management Agency	2007 Illinois Natural Hazard Mitigation Plan
Illinois Water Survey (State Climatologist Office)	Climate Data
United States Geological Survey	Physiographic/Hill Shade Map, Earthquake Information, Hydrology
Illinois State Geological Survey	Geologic, Karst Train, Physiographic Division and Coal Mining Maps

1.6 Review of Existing Plans

Union County and its associated local communities utilize a variety of planning documents to direct community development. These documents include land use plans, master plans, emergency response plans, municipal ordinances, and building codes. The MHMP planning process incorporated the existing natural hazard mitigation elements from these previous planning efforts. Table 1-4 lists the plans, studies, reports, and ordinances used in the development of the plan.

Table 1-4: Planning Documents Used for MHMP Planning Process

Author(s)	Year	Title	Description	Where Used
Illinois Emergency Management Agency	2007	Illinois Natural Hazard Mitigation Plan	The Illinois Natural Hazard Mitigation Plan (INHMP) establishes a process for identifying and mitigating the effects of natural hazards in the State of Illinois as required under the Disaster Mitigation Act of 2000.	Mitigation Actions/Projects
Southern Five RPC	2007 – 2010	Comprehensive Economic Development Strategy (CEDS)	Lists economic and community projects for local governments. Includes mitigation to prevent developing in floodplain and building safer structures to withstand a potential earthquake.	Background and Mitigation Actions/ Projects

Section 2 - Jurisdiction Participation Information

The jurisdictions included in this multi-jurisdictional plan are listed in Table 2-1.

Table 2-1: Participating Jurisdictions

Jurisdiction Name
Union County
Village of Alto Pass
City of Anna
Village of Cobden
Village of Dongola
City of Jonesboro

2.1 Adoption by local governing body

The draft plan was made available to the planning team and other agencies on March 9th 2010, for review and comments. The Union County Hazard Mitigation Planning team presented and recommended the plan to the Union County Board, the cities of Anna and Jonesboro, and the Villages of Alto Pass, Cobden, and Dongola, who adopted the Union County Hazard Mitigation Plan on *<date adopted>*. Resolution adoptions are included in Appendix C of this plan.

2.2 Jurisdiction Participation

It is required that each jurisdiction participates in the planning process. Each of the incorporated communities within Union County was invited to participate on the planning team. In addition to verbal invitation by the Southern Five Regional Planning District and Planning Commission certified letters were sent to each of the heads of incorporated communities in Union County. See Appendix A for an example of mailed letter. Table 2-2 lists each jurisdiction and describes its participation in the construction of this plan.

Table 2-2: Jurisdiction Participation

Jurisdiction Name	Participating Member	Participation Description
Union County	Todd Harris, David Livesay, Jana Fear, Mike Yates, Dana Pearson	Member, MHMP planning committee
Village of Alto Pass	Crystal Gurley, Donald Rehmer	Member, MHMP planning committee
City of Anna	Bill Jackson, Mike Stoner, Al Kamp	Member, MHMP planning committee
Village of Cobden	Alan Eddington and Larry Nace	Member, MHMP planning committee

Jurisdiction Name	Participating Member	Participation Description
Village of Dongola	Dale Aden	Member, MHMP planning committee
City of Jonesboro	Jimmy Watkins, Bill Ecker	Member, MHMP planning committee

All members of the MHMP planning committee were actively involved in attending the MHMP meetings, providing available Geographic Information System (GIS) data and historical hazard information, reviewing and providing comments on the draft plans, coordinating and participating in the public input process, and coordinating the county's formal adoption of the plan. Each meeting culminated with an open forum to invite questions and input from the council members. Appendix A provides further description of the meetings, including dates.

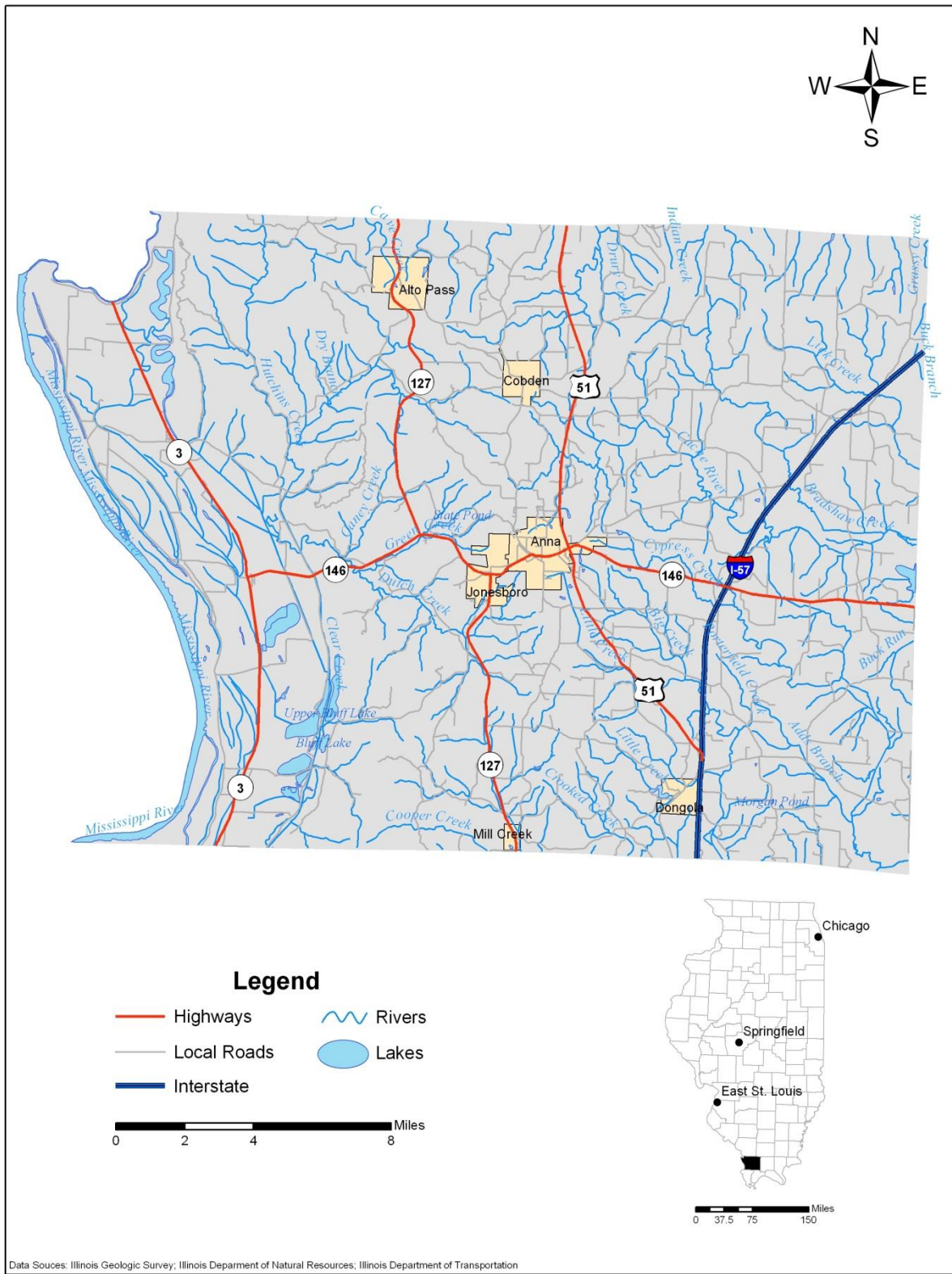
Section 3 - Jurisdiction Information

Union County was formed out of Johnson County in 1818 when the state of Illinois was formed. The County was named for the federal union of the American States. The County Seat is Jonesboro.

Union County is located along the Mississippi River with the southernmost portions of Illinois. It is bounded on the north by Jackson County, Williamson County on northeast, on the south by the Alexander County, on the southeast by Pulaski County, on the East by Johnson County and on the west by the Mississippi River. It relates to major urban areas as follows: 90 miles southeast of St. Louis, Missouri; 160 miles south of Springfield, Illinois; 310 miles south-southwest of Chicago, Illinois. Figure 3-1 shows the location of Union County.

The major sources of economic activity in Union County include manufactures such as Dynoblen which manufactures explosives and the Anna Quarry. The Shawnee National Forest offer tourists and the resident population opportunities for fishing, hunting, boating, camping, and hiking. Several wineries are located within Union County. These establishments are linked together by the Shawnee Hills Wine Trail. Wine tasting, several seasonal festivals, and associated entertainment draw a significant number of tourists each year to Union County. The towns and villages in Union County also offer amenities, such as restaurants, entertainment, and shopping on a rural community scale.

Figure 3-1: Map of Union County



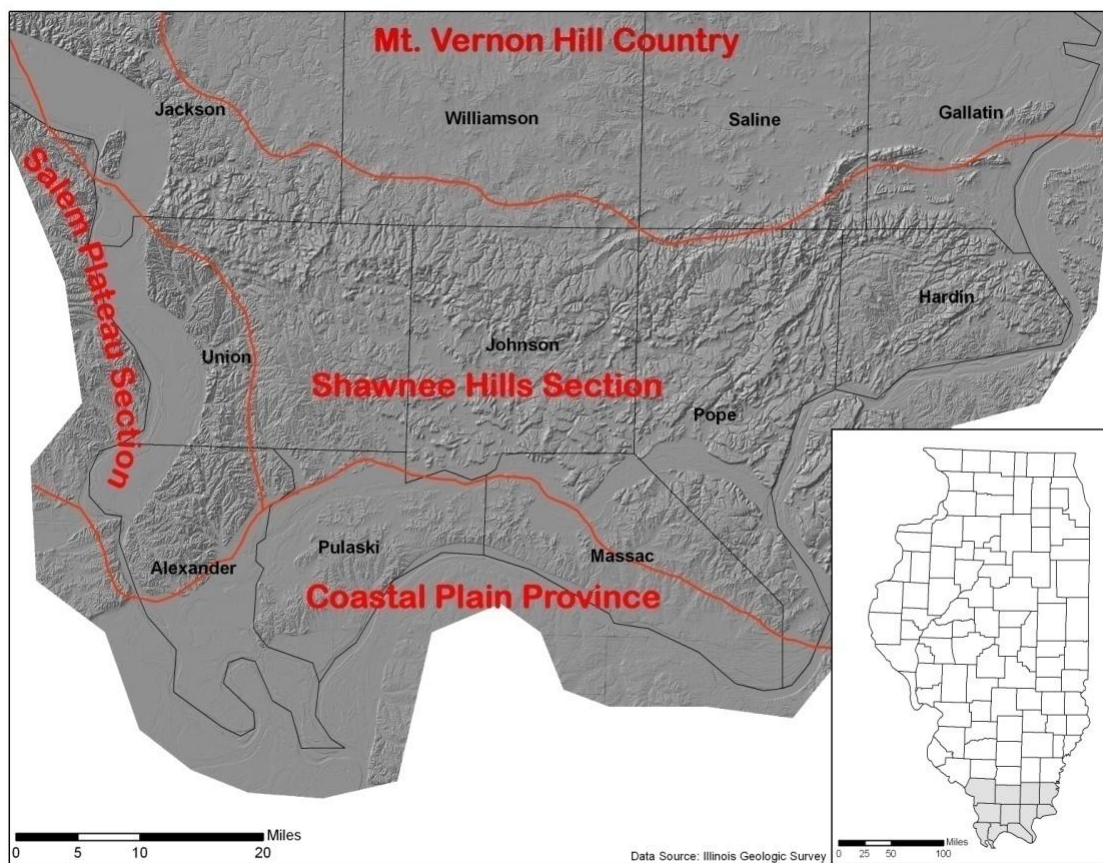
3.1 Physical Setting (Topography)

Union County is located within two physiographic proveniences the Salem Plateau Section in the western half of the County and Interior Low Plateaus Province (Shawnee Hills) in the eastern half the County. The Salem (Ozark) Plateau Province is formed by limestone and dolomites which overlie the Cambrian and Ordovician carbonate rocks with streams dissecting it in varying degrees. Along the drainage divides, the area has been best preserved as a rolling upland surface with a local relief of 100–200 feet. Karst features such as sinkholes, springs, and caves are prominent.

The Low Plateaus Province or Shawnee Hills are underlain by sandstone and limestone bedrock. In areas of sandstone bedrock, the topography is characterized by bluffs, steep-sided ridges, and hills with narrow to broad valleys. In areas of limestone bedrock, the terrain tends to be similar in character but the slopes tend to be less-steep with broader valleys. Because of the limestone bedrock sinkhole and caves are commonly found in these areas.

The highest elevation (1,030 feet above sea level) in Union County is found on Bald Knob located in the northeastern portion of the County. The lowest elevation(s) (~322 feet above sea level) are found in the southeastern corner of the county along Mississippi River. Figure 3-2 depicts the physiographic division within Union County and it characteristics.

Figure 3-2: Physiographic Divisions of Union County



3.2 Climate

Union County climate is typical characterized by hot dry summers and cool wet winters. The variables of temperatures, precipitation, and snowfall can vary greatly from one year to the next. In summer, the average low is 65.0° F and average high is 87.9° F; however, daily maximum temperatures often exceed 103° F for the period of time (weeks) between June and September.

During the fall and into the spring, freezing temperatures can occur any time between late September and early May. The average low and high temperatures in January are 27.0° F and 45.3° F, respectively. Average annual precipitation is 47.4 inches (IL State Climatologist Data from 1928 to 2008 at Anna, IL). While the winters are generally cool, i.e. temperatures are above freezing most days, extended periods (days to a couple of weeks) of sub-freezing temperatures often occur and are sometimes accompanied by significant amounts of ice and snow.

3.3 Demographics

According the U.S. Census of 2006, Union County is estimated to have a population of 18,261. The population of Union County has decreased by 0.2% between 2000 and 2006. The largest town in Union County is Anna with a population of approximately. The breakdown of population by incorporated areas is included in Table 3-1.

Table 3-1: Population by Community

Community	2000 Population	% of County
Village of Alto Pass	388	2.1%
City of Anna	5,136	28.1%
Village of Cobden	1,116	6.1%
Village of Dongola	806	4.4%
City of Jonesboro	1,853	10.1%
Rural Population	9,299	49.2%

Source: American FactFinder, 2009 and Illinois MapStats, 2009

3.4 Economy

Illinois MapStats and Illinois Department of Employment Security report for 2007 and 2008 state that 68% of the workforce in Union County was employed in the private sector. The breakdown is included in Table 3-2. Public administration was the largest sector, employing approximately 32.3% of the workforce and the majority of the workforce earnings, approximately 38%. The US Census 2005 annual per capita income (inflation adjusted) in Union County is \$ 24,071 compared to an Illinois average of \$ 36,264.

Table 3-2: Industrial Employment by Sector

Industrial Sector	% of County Workforce (2007)
Agriculture, Forestry, Fishing, Hunting, and Mining	4.9%
Construction	3.7%
Manufacturing	7.6%
Wholesale Trade	1.6%
Retail Trade	12.4%
Transportation, Warehousing and Utilities	2.7%
Information	0.3%
Finance, Insurance, Real Estate, and Rental/Leasing	2.9%
Professional and Business Services	2.1%
Educational, Health, and Social Services	21.7%
Arts, Entertainment, Recreation, Accommodation and Food Services	6.0%
Other Services (except Public Administration)	1.8%
Public Administration	32.3%

Source: Illinois Department of Employment Security 2008 and Illinois MapStats, 2009

3.5 Industry

Union County's major employers and number of employees are listed in Table 3-3. The largest employers in Union County are Dyno Nobel Inc, Anna Quarry, Choate Mental Health, Union County Hospital, and Flamm Orchards. Public administration, manufacturing, retail trade, education, health and social services are the largest employment sectors in the county.

Table 3-3: Major Employers

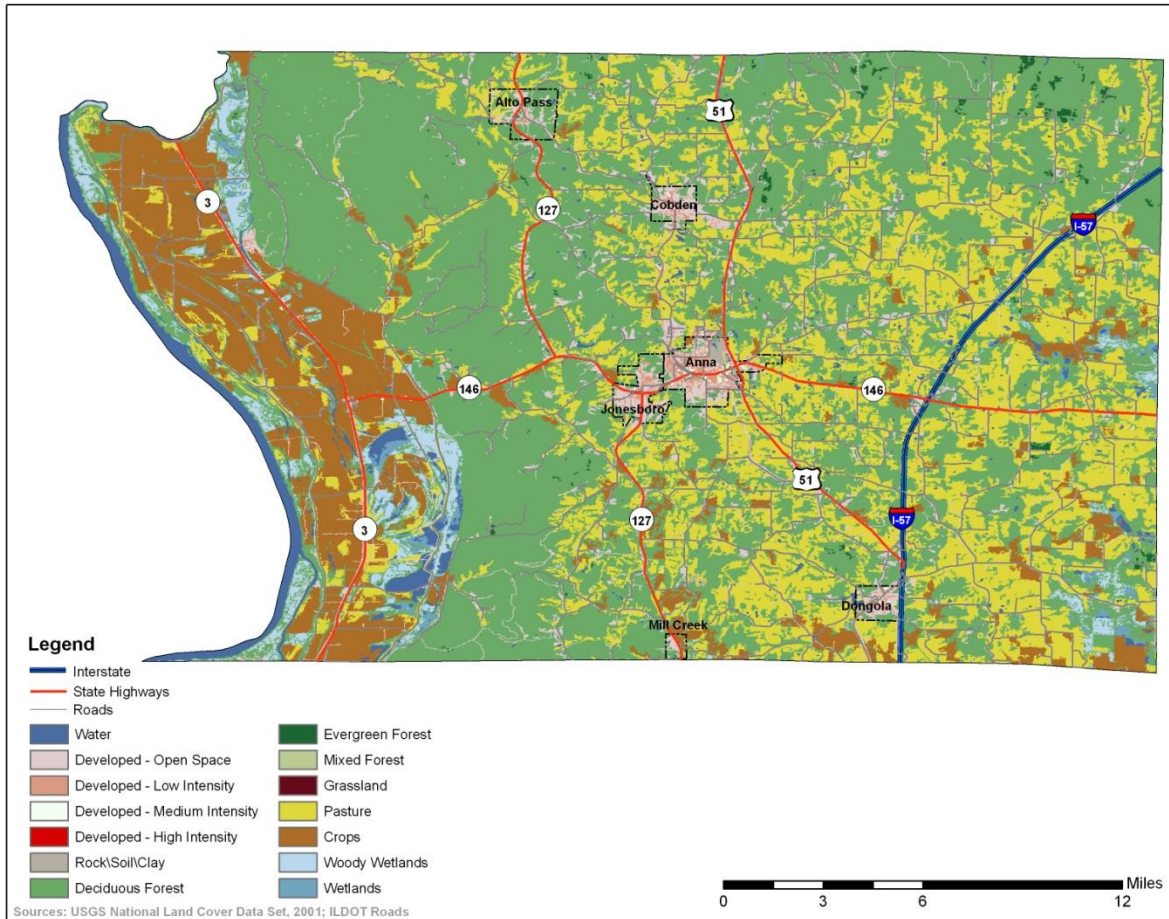
Manufacturing				
Company Name	Location	Established	Employees	Type of Business
Dyno Nobel Inc	Wolf Lake		100 – 249	Dynamite Manufacturing
Agriculture and Wholesale				
Flamm Orchards	Cobden		100-249	Fruits and vegetable whole sale
Educational, Health, and Social Services				
Choate Mental Health	Anna		250 – 499	Hospital
Union County Hospital	Anna		100 – 249	Hospital

Source: Department of Commerce and Economic Opportunity, Community Profiles 2007; and Direct Contact

3.6 Land Uses and Development Trends

Pre-European settlement, Union County was a land of dense upland and floodplain forests. Since settlement, agriculture, logging, and urbanization have dramatically altered the county's land cover. Today, the land cover is a near equally mix of forest and agriculture. A significant portion of the uplands in Union County remain forested in part because of the Shawnee National Forest and the soils found in these areas are not well suited to agriculture. Agriculture is predominantly found on the floodplain of the Mississippi River and the bottomlands of the large streams in Union County. Relatively small portions of the uplands have been converted to pasture and low to medium intensity development is found within the boundaries of the larger incorporated communities in the County (Figure 3-3).

Recent developments in Union County have been mostly confined to the cities of Anna and Jonesboro. The recent development in these cities is attributed to modest increases in employment by the counties major employers. Any significant growth in Union County within the next five years is expected to be in or near these communities.

Figure 3-3: Land Cover of Union County

3.7 Major Lakes, Rivers, and Watersheds

Union County is located along the Mississippi River. Union County is located on the divide between three major surface-water basins. Streams along the northern most portions of the county are located within the Big Muddy River Basin. The streams located in the eastern half of the county (east of Cobden and Anna) are part of the Cache River Basin which drains into the Ohio River and stream located in the western half of the county drain directly into the Mississippi River. The rivers and larger streams in the county include the Mississippi River, Cache River, Big Creek, Cypress Creek, Durury Creek, Dutch Creek, and Hutchings Creek. There are two significant lakes in Union County Bluff and Upper Bluff Lakes located on the Mississippi River Floodplain (Figure 3-1).

Section 4 - Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation must be based on sound risk assessment. Risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people. This assessment identifies the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets. A risk assessment consists of three components: hazard identification, vulnerability analysis, and risk analysis.

4.1 Hazard Identification/Profile

4.1.1 Existing Plans

The previous Union County Comprehensive Emergency Management Plan (CEMP) did not contain a risk analysis. Additional local planning documents were reviewed to identify historical hazards and help identify risk. To facilitate the planning process, digital flood insurance rate maps (DFRIM) were used for the flood analysis.

4.1.2 National Hazard Records

4.1.2.1 National Climatic Data Center (NCDC) Records

To assist the planning team, historical storm event data was compiled from the National Climatic Data Center (NCDC). NCDC records are estimates of damage reported to the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to given weather events.

The NCDC data included 251 reported events in Union County between March 4, 1955 and the February 11, 2008 (the most updated information as of the date of this plan). A summary table of events related to each hazard type is included in the hazard profile sections that follow. A full table listing all events, including additional details, is included as Appendix D. In addition to NCDC data, Storm Prediction Center (SPC) data associated with tornadoes, strong winds, and hail were plotted using SPC recorded latitude and longitude. These events are plotted and included as Appendix E. The list of NCDC hazards is included in Table 4-1.

Table 4-1: Climatic Data Center Historical Hazards

Hazard
Tornadoes
Severe Thunderstorms
Drought/Extreme Heat
Winter Storms
Flood/Flash flood

4.1.2.2 FEMA Disaster Information

Since 1965 there have been 50 Federal Disaster Declarations for the state of Illinois. Emergency declarations allow states access to FEMA funds for Public Assistance (PA); disaster declarations allow for even more PA funding including Individual Assistance (IA) and the Hazard Mitigation Grant Program (HMGP). Union County has received Federal aid for 12 declared disasters since 1969. Figure 4-1 depicts the disasters and emergencies that have been declared for Union County within the past decade. Table 4-2 lists more specific information for each declaration.

Figure 4-1: FEMA-Declared Emergencies and Disasters in Union County (1965-present)

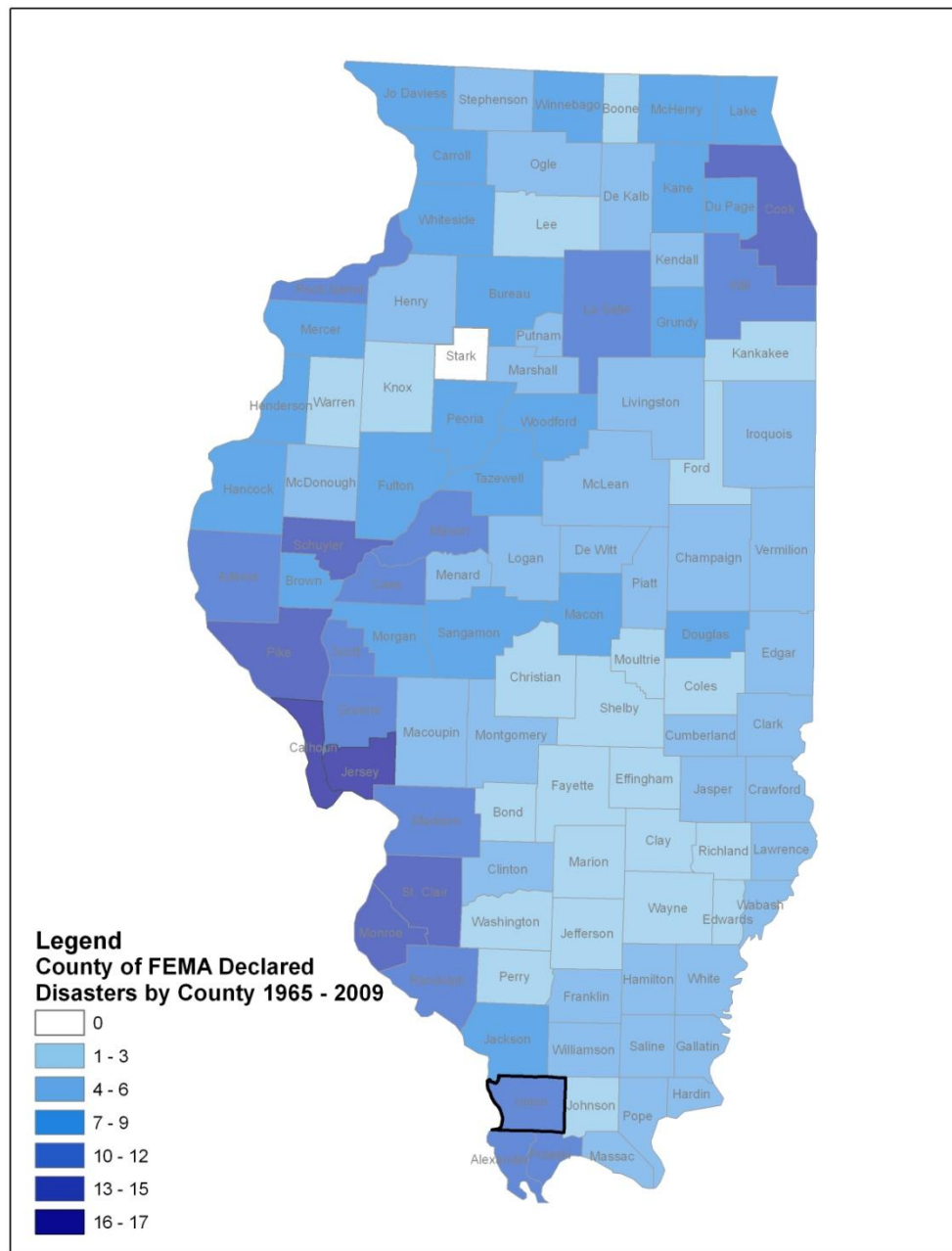


Table 4-2: FEMA-Declared Emergencies in Union County (1969-present)

Date of Incident	Declaration Number	Date of Declaration	Disaster Description	Type of Assistance
	276	8/30/1969	Flooding	
	373	6/7/1973	Severe Storms, Flooding	
	583	4/30/1973	Severe Storms, Flooding	
12/2/1982	674	12/17/1982	Severe Flooding, Torrential Rains	
4/17/1983	684	5/11/1983	Tornado, Flooding, Unseasonable Freezing Temperatures	
7/7/1993	997	7/2/1993	Riverine Flooding and Flash Flooding	
5/13/1995	1053	5/23/1995	Torrential Rains, Excessive Precipitation, Flooding	
4/28/2002	1416	4/29/2002	Severe Thunderstorms, High Winds, Torrential Rains, Flash Flooding	IA and PA
5/4/2003	1469	5/15/2003	Flooding	
4/12/2004	3199	2/1/2005	Tornadoes, Severe Storms, and Flooding	
1/30/2009	1826	3/2/2009	Severe Winter Storm	
5/30/2009	1850	7/22/2009	Severe Winter Storm	

4.1.3 Planning Team

During Meeting #2, which occurred on December 10, 2008, the planning team developed and ranked a list of hazards that affect the county. The team identified 1) severe thunderstorms with tornadoes, 2) earthquakes, 3) winter storms, 4) flooding which occurs on an annual basis during the spring and, 5) wild fire. The plan also identified Union County's principal technological hazards (in order of likelihood): 1) dam or levee failure, 2) land transportation accidents with hazardous material release, and 3) fire\explosion.

4.1.4 Hazard Ranking Methodology

Based on planning team input, national datasets, and existing plans, Table 4-3 lists the hazards Union County will address in this multi-hazard mitigation plan. In addition, these hazards ranked the highest based on the Risk Priority Index discussed in section 4.1.5.

Table 4-3: Planning Team Hazard List

Hazard
Tornado
Earthquakes
Dam or Levee Failure
Thunderstorms/ High Winds / Hail / Lightning
Transportation Hazardous Material Release
Winter Storms
Flooding
Wildfire / Fire / Explosion

4.1.5 Calculating the Risk Priority Index

The first step in determining the Risk Priority Index (RPI) was to have the planning team members generate a list of hazards which have befallen or could potentially befall their community. Next, the planning team members were asked to assign a likelihood rating based on the criteria and methods described in the following table. Table 4-4 displays the probability of the future occurrence ranking. This ranking was based upon previous history and the definition of hazard. Using the definitions given, the likelihood of future events is "Quantified" which results in the classification within one of the four "Ranges" of likelihood.

Table 4-4: Future Occurrence Ranking

Probability	Characteristics
<i>4 - Highly Likely</i>	Event is probable within the calendar year. Event has up to 1 in 1 year chance of occurring. (1/1=100%) History of events is greater than 33% likely per year.
<i>3 - Likely</i>	Event is probable within the next three years. Event has up to 1 in 3 years chance of occurring. (1/3=33%) History of events is greater than 20% but less than or equal to 33% likely per year.
<i>2 - Possible</i>	Event is probable within the next five years. Event has up to 1 in 5 years chance of occurring. (1/5=20%) History of events is greater than 10% but less than or equal to 20% likely per year.
<i>1 - Unlikely</i>	Event is possible within the next ten years. Event has up to 1 in 10 years chance of occurring. (1/10=10%) History of events is less than or equal to 10% likely per year.

Next, planning team members were asked to consider the potential magnitude/severity of the hazard according to the severity associated with past events of the hazard. Table 4-5 gives four classifications of magnitude/severity.

Table 4-5: Hazard Magnitude

Magnitude/Severity	Characteristics
<i>8 - Catastrophic</i>	Multiple deaths. Complete shutdown of facilities for 30 or more days. More than 50% of property is severely damaged.
<i>4 - Critical</i>	Injuries and/or illnesses result in permanent disability. Complete shutdown of critical facilities for at least 14 days. More than 25% of property is severely damaged.
<i>2 - Limited</i>	Injuries and/or illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than seven days. More than 10% of property is severely damaged.
<i>1 - Negligible</i>	Injuries and/or illnesses are treatable with first aid. Minor quality of life lost. Shutdown of critical facilities and services for 24 hours or less. Less than 10% of property is severely damaged.

Finally, the RPI was calculated by multiplying the probability by the magnitude/severity of the hazard. Using these values, the planning team members were then asked to rank the hazards. Table 4-6 identifies the RPI and ranking for each hazard facing Union County.

Table 4-6: Union County Hazards (RPI)

Hazard	Probability	Magnitude/Severity	Risk Priority Index	Rank
Tornado	4 - Highly Likely	8 - Catastrophic	32	1
Earthquakes	2 - Possible	8 - Catastrophic	16	2
Dam or Levee Failure	3 - Likely	4 - Critical	12	3
Thunderstorms/ High Winds/Hail/ Lightning	4 - Highly Likely	2 - Limited	8	4
Transportation Hazardous Material Release	2 - Possible	4 - Critical	8	5
Winter Storms	3 - Likely	2 - Limited	6	6
Flooding	3 - Likely	2 - Limited	6	7
Wildfire/Fire/Explosion	2 - Possible	1 - Negligible	4	8

4.1.6 Jurisdictional Hazard Ranking

Because the jurisdictions in Union County differ in their susceptibilities to certain hazards—for example, the village of Dongola located on the Little Creek Floodplain is more likely to experience significant flooding than Alto Pass which is located a substantial distance away from any substantial stream or river which could potentially cause significant flooding—the hazards identified by the planning team were ranked by SIUC for each individual jurisdiction using the methodology outlined in Section 4.1.5. The SIUC rankings were based on input from the planning team members, available historical data, and the hazard modeling results described within this hazard mitigation plan. During the five-year review of the plan, this table will be updated by the planning team to ensure these jurisdictional rankings accurately reflect each community's assessment of these hazards. Table 4-7 lists the jurisdictions and their respective hazard rankings (Ranking 1 being the highest concern).

Table 4-7: Hazard Rankings by Jurisdiction

Jurisdiction	Hazard							
	Tornado	HAZMAT	Earthquake	Thunderstorms	Flooding	Winter Storms	Levee Failure	Wild Fire/ Fire/Explosion
City of Anna	1	4	2	3	6	5	NA	7
Village of Alto Pass	1	5	2	3	6	4	NA	7
Village of Cobden	1	5	2	3	6	4	NA	7
Village of Dongola	1	4	2	3	6	5	NA	7
City of Jonesboro	1	4	2	3	6	5	NA	7

NA = Not applicable

4.1.7 GIS and HAZUS-MH

The third step in this assessment is the risk analysis, which quantifies the risk to the population, infrastructure, and economy of the community. Where possible, the hazards were quantified using GIS analyses and HAZUS-MH. This process reflects a level two approach to analyzing hazards as defined for HAZUS-MH. The approach includes substitution of selected default data with local data. Level two analysis significantly improves the accuracy of the model predictions.

HAZUS-MH generates a combination of site-specific and aggregated loss estimates depending upon the analysis options that are selected and upon the input that is provided by the user. Aggregate inventory loss estimates, which include building stock analysis, are based upon the assumption that building stock is evenly distributed across census blocks/tracts. Therefore, it is possible that overestimates of damage will occur in some areas while underestimates will occur in other areas. With this in mind, total losses tend to be more reliable over larger geographic areas than for individual census blocks/tracts. It is important to note that HAZUS-MH is not intended to be a substitute for detailed engineering studies. Rather, it is intended to serve as a planning aid for communities interested in assessing their risk to flood-, earthquake-, and hurricane-related hazards. This documentation does not provide full details on the processes and procedures completed in the development of this project. It is only intended to highlight the major steps that were followed during the project.

Site-specific analysis is based upon loss estimations for individual structures. For flooding, analysis of site-specific structures takes into account the depth of water in relation to the structure. HAZUS-MH also takes into account the actual dollar exposure to the structure for the costs of building reconstruction, content, and inventory. However, damages are based upon the assumption that each structure falls into a structural class, and that structures in each class will respond in similar fashion to a specific depth of flooding. Site-specific analysis is also based upon a point location rather than a polygon; therefore the model does not account for the percentage of a building that is inundated. These assumptions suggest that the loss estimates for site-specific structures as well as for aggregate structural losses need to be viewed as approximations of losses that are subject to considerable variability rather than as exact engineering estimates of losses to individual structures.

The following events were analyzed. The parameters for these scenarios were created using GIS, HAZUS-MH, and historical information to predict which communities would be at risk.

Using HAZUS-MH

1. 100-year overbank flooding
2. Earthquake

Using GIS

1. Tornado
2. Hazardous Material Release

4.2 Vulnerability Assessment

4.2.1 Asset Inventory

4.2.1.1 Processes and Sources for Identifying Assets

The HAZUS-MH data is based on best available national data sources. The initial step involved updating the default HAZUS-MH data using State of Illinois data sources. At Meeting #1, the planning team members were provided with a plot and report of all HAZUS-MH critical facilities. The planning team took GIS data provided by SIU-Polis, verified the datasets using local knowledge, and allowed SIU-Polis to use their local GIS data for additional verification. SIU-Polis GIS analysts made these updates and corrections to the HAZUS-MH data tables prior to performing the risk assessment. These changes to the HAZUS-MH inventory allow a level two analysis. This update process improved the accuracy of the model predictions.

The default HAZUS-MH data has been updated as follows:

- The HAZUS-MH defaults, critical facilities, and essential facilities have been updated based on most recent available data sources. Critical and essential point facilities have been reviewed, revised, and approved by local subject matter experts at each county.
- The essential facility updates (schools, medical care facilities, fire stations, police stations, and EOCs) have been applied to the HAZUS-MH model data. HAZUS-MH reports of essential facility losses reflect updated data.
- Parcels with assessment improvements (buildings) values were used to estimate the number of buildings in the flood-prone areas.
- The analysis is restricted to the county boundaries. Events that occur near the county boundary do not contain damage assessments from the adjacent county.

4.2.1.2 Essential Facilities List

Table 4-8 identifies the critical facilities that were added or updated for the analysis. A complete list of the critical facilities is included as Appendix F. A map of all the critical facilities is included as Appendix G.

Table 4-8: Critical Facilities List

Facility	Number of Facilities
Care Facilities	20
Emergency Operation Centers	4
Fire Stations	6
Police Stations	5
Schools	18

4.2.1.3 Facility Replacement Costs

Default HAZUS-MH building stock data were used for the HAZUS-MH analyses. Facility replacement costs and total building exposure are identified in Table 4-9. Table 4-9 also includes the estimated numbers of buildings within each occupancy class.

Table 4-9: Building Exposure (default HAZUS-MH) for Union County

General Occupancy	Estimated Total Buildings	Total Building Exposure (X 1000)
Agricultural	24	\$16,535
Commercial	133	\$203,898
Education	6	\$23,383
Government	13	\$11,771
Industrial	19	\$34,222
Religious/Non-Profit	15	\$35,524
Residential	7,268	\$831,693
Total	7,478	\$1,121,502

Union County provided parcel boundaries with assessed values. The parcel data was used to estimate the actual number of buildings within the flood-prone areas. The parcel data identified parcels with building improvements, which were then converted into centroid point locations. The parcels with improvements are summarized by occupancy class in Table 4-10.

Table 4-10: Parcels with Improvements by Occupancy Class for Union County

Occupancy Class	Number of Structures
Residential	4,769
Commercial	435
Industrial	5
Agriculture	1,853
Exempt	29
Total	7,091

4.3 Future Development

Union County is subject to a variety of natural disasters. County government, in partnership with State government, must make a commitment to prepare for those types of disasters. Likewise, the Union County manufacturing base leaves the county vulnerable to major hazardous materials events and other technological threats. However, as the county-elected and appointed officials become better informed on the subject of community hazards, they will be better able to set and direct policies that will enable emergency management and county response agencies to effectively plan, train, and exercise. The end result will be a stronger community and a better place in which to work, live, and grow.

4.4 Hazard Profiles

4.4.1 Tornado Hazard

Hazard Definition for Tornado Hazard

Tornadoes pose a great risk to the State of Illinois and its citizens. Tornadoes historically have occurred during any month of the year. The unpredictability of tornadoes makes them one of Illinois' most dangerous hazards. Their extreme winds are violently destructive when they touch down in the region's developed and populated areas. Current estimates place the maximum velocity at about 300 mph, but higher and lower values can occur. A wind velocity of 200 mph will result in a wind pressure of 102.4 pounds per square foot of surface area, a load that exceeds the tolerance limits of most buildings. Considering these factors, it is easy to understand why tornadoes can be so devastating for the communities they hit.

Tornadoes are defined as violently-rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground. However, the violently-rotating column of air can reach the ground very quickly and become a tornado. If the funnel cloud picks up and blows around debris, it has reached the ground and is a tornado.

Tornadoes are classified according to the Fujita tornado intensity scale. The tornado scale ranges from low intensity F0, with effective wind speeds of 40 to 70 mph, to F5 tornadoes with effective wind speeds of over 260 mph. The Fujita intensity scale is included in Table 4-10.

Table 4-11: Fujita Tornado Rating

Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
0 (Gale)	40–72 mph	6–17 yards	0.3–0.9 miles	Light damage, some damage to chimneys, branches broken, sign boards damaged, shallow-rooted trees blown over.
1 (Moderate)	73–112 mph	18–55 yards	1.0–3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes pushed off foundations, attached garages damaged.
2 (Significant)	113–157 mph	56–175 yards	3.2–9.9 miles	Considerable damage, entire roofs torn from frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted.
3 (Severe)	158–206 mph	176–566 yards	10–31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.
4 (Devastating)	207–260 mph	0.3–0.9 miles	32–99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
5 (Incredible)	261–318 mph	1.0–3.1 miles	100–315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

Previous Occurrences for Tornado Hazard

There have been several occurrences of tornadoes within Union County during recent decades. The NCDC database reported 14 tornadoes/funnel clouds in Union County since 1955. These

tornados have been attributed with one death, 13 injuries, and \$5.7 million dollars in property damage within Union and adjacent counties. As of April 2008, the most recent tornado touch down occurred on January 29, 2008. This tornado, crossed the Mississippi River from Cape Girardeau County, Missouri. During its short path in Union County, a large grain bin was blown onto a road. Numerous shingles were blown off a farm house. A couple of trees were uprooted. The average path width was 50 yards.

Union County tornadoes recorded in the NCDC database are identified in Table 4-12. Additional details for NCDC events are included in Appendix D.

Table 4-12: Union County Tornadoes*

Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Union	3/4/1955	Tornado	F1	0	0	0K
Union	11/16/1955	Tornado	F2	0	0	250K
Union	5/21/1957	Tornado	F3	0	0	250K
Union	8/9/1969	Tornado	F0	0	0	3K
Union	4/14/1972	Tornado	F2	0	4	25K
Union	4/14/1972	Tornado	F2	0	0	25K
Union	6/2/1973	Tornado	F0	0	0	0K
Union	2/16/1976	Tornado	F2	0	1	25K
Reynoldsville	1/21/1999	Tornado	F2	0	0	20K
Anna	1/21/1999	Tornado	F0	0	0	1K
Dongola	4/28/2002	Tornado	F3	1	8	5.0M
Wayside	10/18/2004	Tornado	F1	0	0	4K
Jonesboro	3/1/2007	Tornado	F0	0	0	100K
Wolf Lake	1/29/2008	Tornado	F1	0	0	10K

Source: NCDC

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Tornado Hazard

The entire county has the same risk for occurrence of tornadoes. They can occur at any location within the county.

Hazard Extent for Tornado Hazard

The historical tornadoes listed previously generally move from west to east across the county—although many other tracks are possible—from more southerly to northerly. The extent of the hazard varies both in terms of the extent of the path and the wind speed.

Calculated Risk Priority Index for Tornado Hazard

Based on historical information, the probability of future tornadoes in Union County is likely. Tornadoes with varying magnitudes are expected to happen. According to the RPI, tornadoes ranked as the number one hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
4	x	8	=	32

Vulnerability Analysis for Tornado Hazard

Tornadoes can occur within any area of the county; therefore, the entire county population and all buildings are vulnerable to tornadoes. To accommodate this risk, this plan will consider all buildings located within the county as vulnerable. The existing buildings and infrastructure in Union County are discussed in types and numbers in Table 4-10.

Critical Facilities

All critical facilities are vulnerable to tornadoes. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts will vary based on the magnitude of the tornado, but can include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, and loss of facility functionality (e.g. a damaged police station will no longer be able to serve the community). Table 4-8 lists the types and numbers of all of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure for the entire county is listed in Table 4-9. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, and loss of building function (e.g. a damaged home will no longer be habitable causing residents to seek shelter).

Infrastructure

During a tornado the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a tornado. The impacts to these items include broken, failed or impassable roadways, broken or failed utility lines (e.g. loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

An example scenario is described as follows to illustrate the anticipated impacts of tornadoes in the county in terms of numbers and types of buildings and infrastructure.

Union County Tornado Analysis

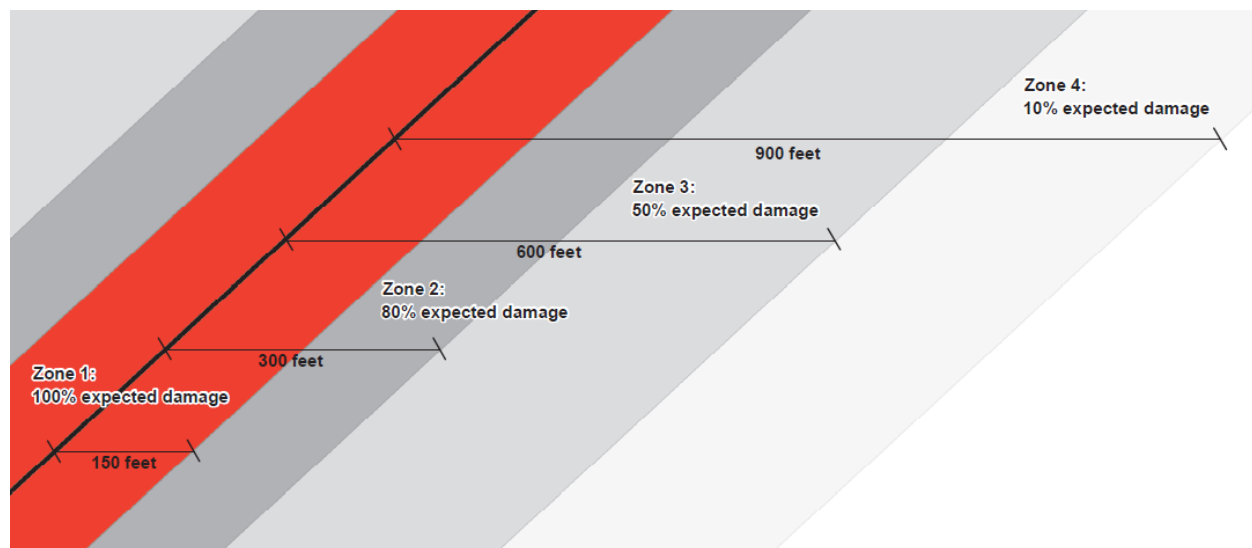
GIS overlay modeling was used to determine the potential impacts of an F4 tornado. The analysis used a hypothetical path based. The selected widths were based on a recreation of the Fujita-Scale guidelines based on conceptual wind speeds, path widths, and path lengths. There is no guarantee that every tornado will fit exactly into one of these six categories. The Fujita Scale guidelines are described in Table 4-13.

Table 4-13: Tornado Path Widths and Damage Curves

Fujita Scale	Path Width (feet)	Maximum Expected Damage
F-5	3000	100%
F-4	2400	100%
F-3	1800	80%
F-2	1200	50%
F-1	600	10%
F-0	300	0%

Within any given tornado path there are degrees of damage. The most intense damage occurs within the center of the damage path with a decreasing amount of damage away from the center of the damage path. This natural process was modeled in GIS by adding damage zones around the tornado path. Figures 4-2 and Table 4-14 describe the zone analysis.

Figure 4-2: GIS Analysis Using Tornado Buffers



Once the hypothetical route is digitized on the map, several buffers are created to model the damage functions within each zone.

An F4 tornado has four damage zones. Total devastation is estimated within 150 feet of the tornado path (the darker colored zone 1). The outer buffer is 900 feet from the tornado path (the lightest colored zone 4), within which 10% of the buildings will be damaged.

Table 4-14: Tornado Zones and Damage Curves

Fujita Scale	Zone	Buffer (feet)	Damage Curve
F-4	4	600-900	10%
F-4	3	300-600	50%
F-4	2	150-300	80%
F-4	1	0-150	100%

The selected hypothetical tornado path is depicted in Figure 4-3, and the damage curve buffers with damaged buildings are shown in Figure 4-4.

Figure 4-3: Hypothetical F-4 Tornado Path in Union County

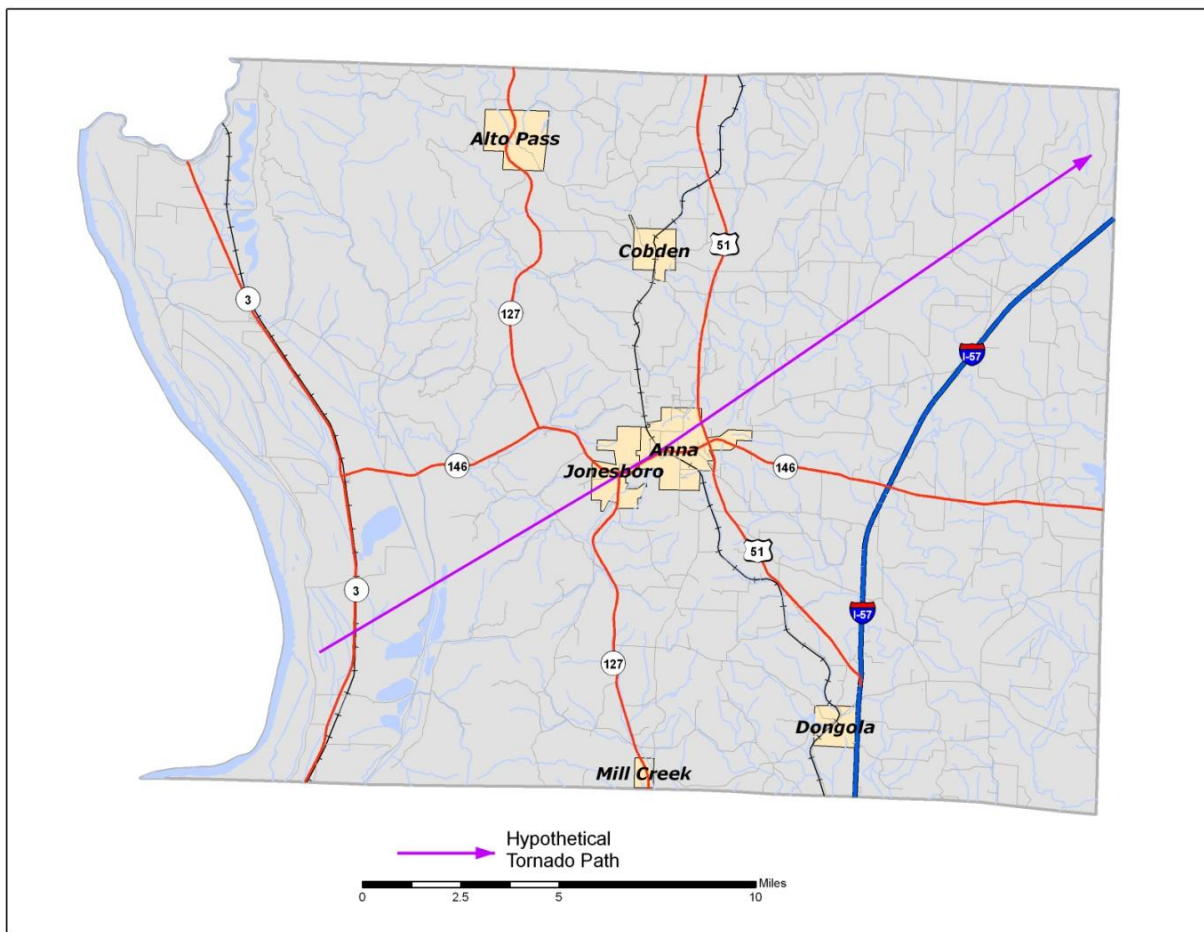
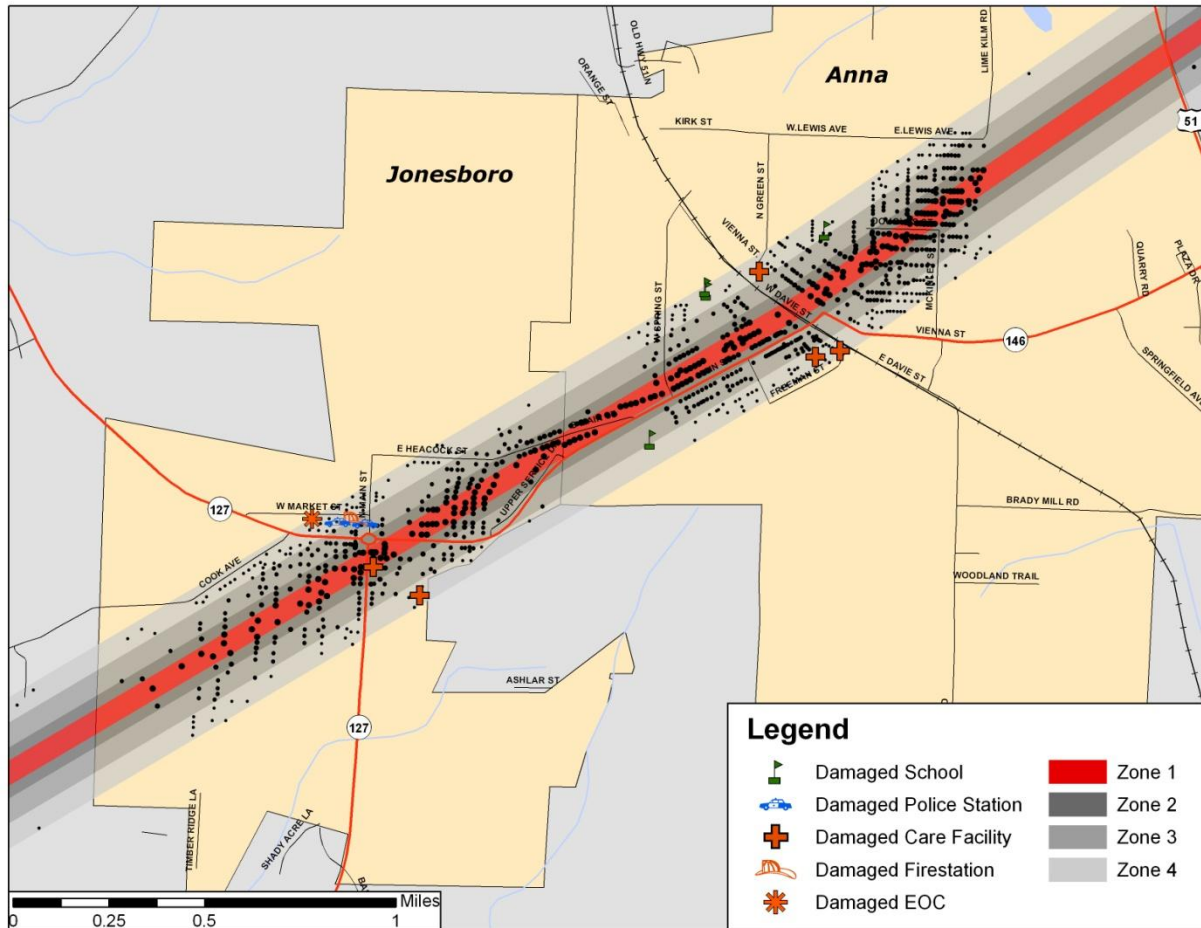


Figure 4-4: Modeled F-4 Tornado Damage Buffers in Anna and Jonesboro

The results of the analysis are depicted in Tables 4-15 and 4-16. The GIS analysis estimates that 1,019 buildings will be damaged. The estimated building losses were approximately \$19.7 million. The building losses are an estimate of assessed values multiplied by the percentages of damage. The overlay was performed against parcels provided by Union County that were joined with Assessor records showing property improvement.

The Assessor records often do not distinguish parcels by occupancy class if the parcels are not taxable. For purposes of analysis, the total number of buildings and the assessed values for government, religious/non-profit, and education should be lumped together as exempt.

Table 4-15: Estimated Numbers of Buildings Damaged by Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	178	156	273	237
Commercial	26	27	68	27
Industrial	0	0	0	1
Agriculture	0	4	8	7
Exempt	0	0	1	7
Total	211	187	366	278

Table 4-16: Estimated Building Losses by Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	\$4,953,540	\$2,830,356	\$6,641,010	\$548,432
Commercial	\$1,233,600	\$3,454,220	\$3,732,800	\$189,122
Industrial	0	0	0	\$7,453
Agriculture	\$369,100	\$136,848	\$400,600	\$30,158
Exempt	0	0	\$777,000	\$511,000
Total	\$6,556,240	\$5,730,580	\$6,164,205	\$1,285,764

Essential Facilities Damage

There are six essential facilities located within 900 feet of the hypothetical tornado path. The model predicts two police departments, two fire departments, one school and one hospital would experience damage. The affected facilities are identified in Table 4-17, and their geographic locations are shown in Figure 4-4.

Table 4-17: Estimated Essential Facilities Affected

Name
Union County Sheriff's Office
Anna Fire Dept
Jonesboro Fire Dept
Spanish Oaks Center
Lincoln Square
Holly Hill Nursing Home
Mulberry Manor
Hidden Valley Care Center
City of Jonesboro PD
Anna Junior High School
Davie Elementary School
Lincoln Elementary School
Anna-Jonesboro High School

Vulnerability to Future Assets/Infrastructure for Tornado Hazard

The entire population and buildings have been identified as at risk because tornadoes can occur anywhere within the State of Illinois, at any time of the day, and during any month of the year. Furthermore, any future development in terms of new construction within the county will be at risk. The building exposure for Union County is included in Table 4-9.

All critical facilities in the county and its communities are at risk. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures should be built with sturdier construction, and existing structures should be hardened to lessen the potential impacts of severe weather. Community sirens to warn of approaching storms are also vital to ensuring the safety of Union County residents.

4.4.2 Flood Hazard

Hazard Definition for Flooding

Flooding is a significant natural hazard throughout the United States. The type, magnitude, and severity of flooding are functions of the amount and distribution of precipitation over a given area, the rate at which precipitation infiltrates into the ground, the geometry and hydrology of the catchment, and flow dynamics and conditions in and along the river channel. Floods can be classified as one of two types: upstream floods or downstream floods. Both types of floods are common in Illinois. Upstream floods, also called flash floods, occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage, and sometimes loss of life, due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person; another eighteen inches might carry off a car. Generally, upstream floods cause damage over relatively localized areas, but they can be quite severe in the local areas where they occur. Urban flooding is a type of upstream flood. Urban flooding involves the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Upstream or flash floods can occur at anytime of the year in Illinois, but they are most common in the spring and summer months.

Downstream floods, sometimes called riverine floods, refer to floods on large rivers at locations with large upstream catchments. Downstream floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for downstream floods than for upstream floods, generally providing ample warning for people to move to safe locations and, to some extent, secure some property against damage. Riverine flooding on the large rivers of Illinois generally occurs during either the spring or summer.

Hazard Definition for Dam and Levee Failure

Dams are structures that retain or detain water behind a large barrier. When full or partially full, the difference in elevation between the water above the dam and below creates large amounts of potential energy, creating the potential for failure. The same potential exists for levees when they serve their purpose, which is to confine flood waters within the channel area of a river and exclude that water from land or communities land-ward of the levee. Dams and levees can fail due to either: 1) water heights or flows above the capacity for which the structure was designed; or 2) deficiencies in the structure such that it cannot hold back the potential energy of the water. If a dam or levee fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage.

Many communities view both dams and levees as permanent and infinitely safe structures. This sense of security may well be false, leading to significantly increased risks. Both downstream of dams and on floodplains protected by levees, security leads to new construction, added infrastructure, and increased population over time. Levees in particular are built to hold back

flood waters only up to some maximum level, often the 100-year (1% annual probability) flood event. When that maximum is exceeded by more than the design safety margin, then the levee will be overtopped or otherwise fail, inundating communities in the land previously protected by that levee. It has been suggested that climate change, land-use shifts, and some forms of river engineering may be increasing the magnitude of large floods and the frequency of levee-failure situations.

In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. Many structures across the U.S. have been underfunded or otherwise neglected, leading to an eventual day of reckoning in the form either of realization that the structure is unsafe or, sometimes, an actual failure. The threat of dam or levee failure may require substantial commitment of time, personnel, and resources. Since dams and levees deteriorate with age, minor issues become larger compounding problems, and the risk of failure increases.

Previous Occurrences for Riverine and Flash Flooding

The NCDC database reported 40 flood events in Union County since 1995. These flood events have been attributed with one death and nearly \$4.9 million in property damage. A recent example of flooding in Union County occurred in May of 2002 when major flooding of the Mississippi River occurred. The river rose above flood stage at Thebes on May 8, which reached its crest of 44.3 feet on May 18. Flood stage at Thebes is 33 feet. This resulted in extensive flooding of farmland and threats to some developments. The levees held up, but structures not protected by levees were flooded. About 30 families evacuated due to flooding of their residences, mainly in the Miller City and McClure areas in adjacent Alexander County. Elsewhere, from Jackson County to Cairo, secondary roads near the river were closed, and parks and farmland were underwater.

Significant Union County floods recorded by the NCDC are shown in Table 4-18. A complete list of flood events and additional information about the significant flood events are included in Appendix D. Historical flood crests and discharges at hydrologic monitoring stations are summarized in Appendix H.

Table 4-18: Union County Previous Occurrences of Flooding*

Location	Date	Type	Deaths	Injuries	Property Damage
Union	5/16/1995	River Flood	0	0	0
Union	6/1/1995	River Flood	0	0	1.9M
Union	5/1/1996	Flood	0	0	50K
Union	6/1/1996	Flood	0	0	0
Union	2/26/1997	Flood	0	0	0
Union	3/1/1997	Flood	0	0	20K
Union	4/4/1998	Flood	0	0	0
Union	5/1/1998	Flood	0	0	0

Location	Date	Type	Deaths	Injuries	Property Damage
Union	6/21/1998	Flood	0	0	0
Anna	6/29/1998	Flash Flood	0	0	0
Union	1/21/1999	Flash Flood	0	0	100K
Union	1/22/1999	Flash Flood	0	0	0
Union	4/20/1999	Flood	0	0	0
Union	5/1/1999	Flood	0	0	12K
Union	6/1/1999	Flood	0	0	0
Union	1/3/2000	Urban/sml Stream Fld	0	0	0
Union	2/28/2001	Flood	0	0	0
Union	3/1/2001	Flood	0	0	0
Union	5/21/2001	Flood	0	0	0
Union	6/8/2001	Flood	0	0	0
Union	12/17/2001	Flash Flood	0	0	0
Union	12/17/2001	Flood	0	0	8K
Union	12/17/2001	Flash Flood	0	0	0
Anna	1/31/2002	Flash Flood	1	0	0
Union	5/8/2002	Flood	0	0	1.5M
Union	5/12/2002	Flash Flood	0	0	8K
Union	5/17/2002	Flash Flood	0	0	0
Union	4/29/2003	Flash Flood	0	0	0
Union	5/6/2003	Flash Flood	0	0	0
Union	5/13/2003	Flood	0	0	0
Union	5/31/2004	Flood	0	0	0
Union	6/1/2004	Flood	0	0	0
Union	1/7/2005	Flood	0	0	0
Union	11/15/2005	Flash Flood	0	0	0
Dongola	3/9/2006	Flash Flood	0	0	30K
Union	8/27/2006	Flash Flood	0	0	0
Union	9/23/2006	Flood	0	0	0
Ware	3/13/2008	Flood	0	0	1.3M
Aldridge	3/19/2008	Flood	0	0	0
Cobden	5/27/2008	Flash Flood	0	0	0

Source: NCDC

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Previous Occurrences for Dam and Levee Dam Failure

Prior to the 1950s, large flood events along the Mississippi River within Union County often overwhelmed local/private levees inundating the floodplain and its communities. Since the completion of the larger levees constructed by the Federal Government in the 1950s, no levee failures have occurred along the Mississippi River within Union County. Along the other streams and rivers in Union County there are no records or local knowledge of any dam or any other certified levee failure in the county.

Repetitive Loss Properties

FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the National Flood Insurance Program (NFIP), which has suffered flood loss damage on two or more occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is 25% of the market value of the structure at the time of each flood loss.

Illinois Emergency Management was contacted to determine the location of repetitive loss structures. Union County has three repetitive loss structures within the county. The total amount paid for building replacement and building contents for damages to these repetitive loss structures is \$31,516.39. Table 4-19 describes the loss structures in terms of occupancy and jurisdiction.

Table 4-19: Union County Repetitive Loss Structures

Jurisdiction	Occupancy Type	Number of Structures	Number of Losses	Total Paid
Union County	Single-Family	1	2	\$7,344.88
Mill Creek	Single-Family	1	2	\$6,148.12
Dongola	Nonresidential	1	2	\$24,761.89
Totals		3	6	\$31,516.39

Geographic Location for Flooding

Most riverine floods in Illinois occur during either the spring or summer and are the result of excessive rainfall and/or the combination of rainfall and snowmelt. Flash flooding in Illinois can occur during anytime of the year, but tends to be less frequent and more localized between mid-summer and early winter.

The primary sources of river flooding in Union County are the Mississippi River, Cache River, Cypress Creek, Dutch Creek, Green Creek, Little Creek, and Mill Creek. Flooding along the Mississippi River in Union County can inundate its bottomland affecting a significant area along the entire western boundary of the county and potential close State Routes 3, 146 and several secondary roads. Flooding along the Cache River, Dutch Creek, Green Creek and their tributaries generally affect unincorporated areas in the center portion of the county and State Route 146. Flooding along Cypress Creek can impact a portion of the east side of Anna and State Route 146. Little Creek can inundate portions of Dongola and Mill Creek can flood portions of the Village of Mill Creek and State Route 127.

Flash flooding in Union County typically occurs or is best documented in urban/developed areas. For example on May 12, 2002 flash flooding struck the small community of Mill Creek, forcing some residents out of their homes. An elderly woman was rescued by boat from her flooded home, and Route 127 was closed. Some residents of the Reynoldsville area of Union County were only able to boat to and from their homes.

The State of Illinois has recently completed the modernization of the Flood Insurance Rate Maps (FIRMs) for Alexander County. These digital files (DFIRMs) were used to identify specific stream reaches for analysis. The areas of riverine flooding are shown on the map in Appendix E

In Meeting #4, held on September 22, 2009, the planning team members listed a voluntary buyout option as a mitigation strategy for areas not protected by federally constructed flood control levees to alleviate damage to structures within the county's flood plain. They identified potential hazard areas in which this program may prove valuable. The results are listed in Table 4-20.

Table 4-20: A list of the general location and potential number of structures for voluntary buyouts

Jurisdiction	Location	Approximate Number of Structures
City of Anna	Cache River Floodplain	5
City of Jonesboro	Green Creek Floodplain	3
Union County	Druary Creek Floodplain	5
Union County	Indian Creek Floodplain	1
Union County	Lick Creek Floodplain	2
Union County	Cache River Floodplain	20
Union County	Big Creek Floodplain	10
Union County	Cypress Creek Floodplain	5
Union County	Mill Creek Floodplain	10
Union County	Cooper Creek Floodplain	5
Union County	Dutch Creek Floodplain	25
Union County	Green Creek Floodplain	25
Union County	Caney Creek Floodplain	5
Union County	Clear Creek Floodplain	25
Village Dongola	Big Creek Floodplain	6

Geographic Location for Dam and Levee Failure

The National Inventory of Dams identified five dams in Union County. The map in Appendix G illustrates the location of Union County dams. Table 4-21 summarizes the National Inventory of Dams information.

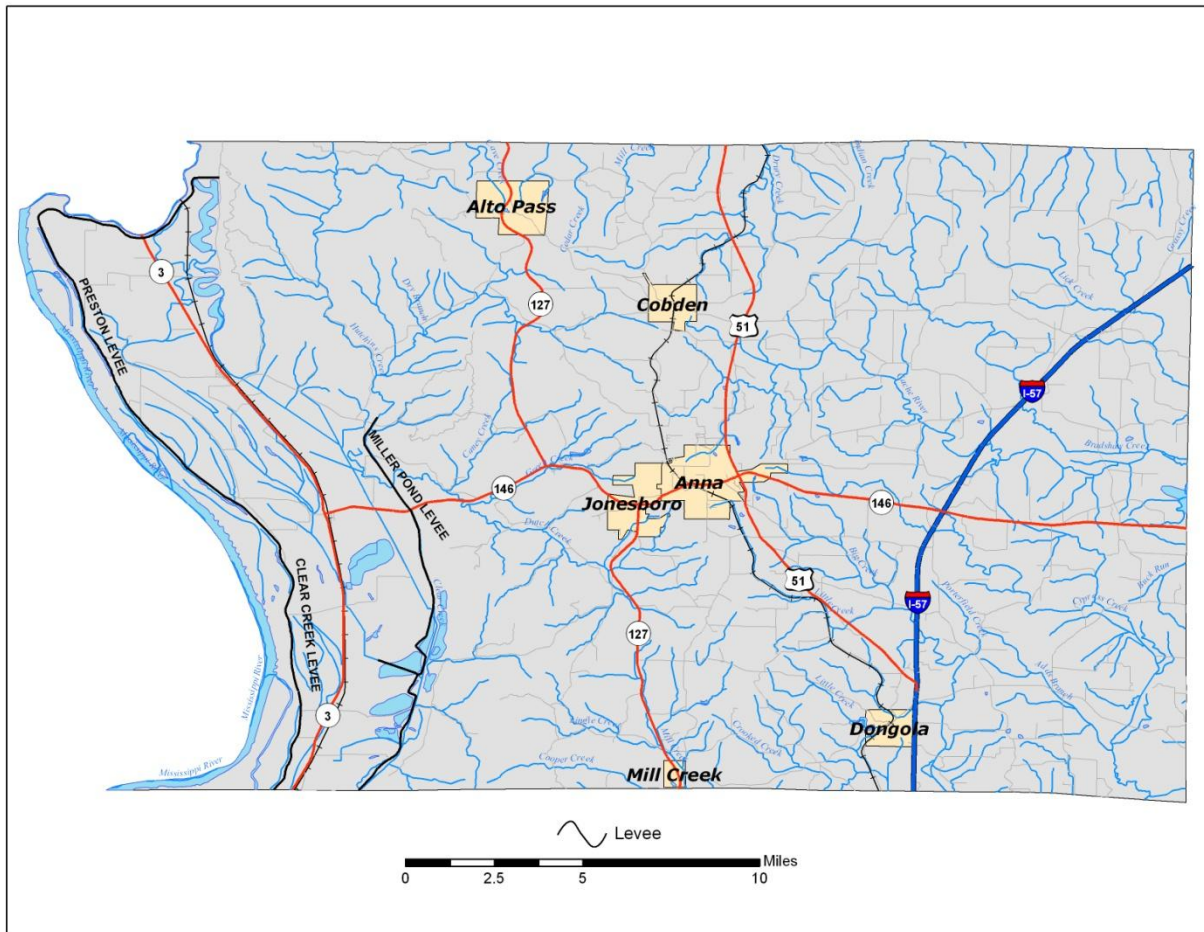
Table 4-21: National Inventory of Dams

Name	River	Hazard	EAP
Dongola Lake Dam	Little Creek	H	Y
Denny's Pond Dam	Tributary to Cache River	L	N
Pine Ridge Lake Dam	Kohler Creek	H	N
Alto Pass Reservoir Dam	Cave Creek	H	Y
Hinz Pond Dam	Tributary to Grassy Creek	L	N

A review of the United States Army Corps of Engineers and IDNR records revealed three levees and three levee districts within Union County. These levees are listed in Table 4-22 and their approximate location shown on Figure 4-5.

Table 4-22: Inventory of Levees

Name	Levee District	Length (mi)	Protection Level	FEMA Certification
Miller Pond	Miller Pond Levee and Drainage District	2.8	50-year event	No
Preston	Preston Levee and Drainage District	14.6	50-year event	No
Clear Creek	Clear Creek Levee and Drainage District	21.0	50-year event	No

Figure 4-5: Union County Levees Map

Hazard Extent for Flooding

The HAZUS-MH flood model is designed to use a flood depth grid and flood boundary polygon from the DFIRM data. HAZUS-MH was used to model the Base Flood Elevation (BFE). The BFE is defined as the area that has a 1% chance of flooding in any given year. Planning team input and a review of historical information provided additional information on specific flood events.

Hazard Extent for Dam and Levee Failure

Dams assigned the low (L) hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property. Dams assigned the significant (S) hazard classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Dams classified as significant hazard potential dams are often located in predominantly rural or agricultural areas, but could be located in populated areas with a significant amount of infrastructure. Dams assigned the high (H) hazard potential classification

are those dams where failure or mis-operation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure.

According to the IDNR and the National Inventory of Dams, three dams in Union County are classified as a high hazard dams. Two of these dams have an Emergency Action Plan (EAP; Table 4-19). An EAP is not required by the State of Illinois but is recommended by the Illinois Department of Natural Resources.

Accurate mapping of the risks of flooding behind levees depends on knowing the condition and level of protection the levees actually provide. FEMA and the U.S. Army Corps of Engineers are working together to make sure that flood hazard maps better reflect the flood protection capabilities of levees and that the maps accurately represent the flood risks posed to areas situated behind them. Levee owners—usually states, communities, or private individuals or organizations such as local levee districts—are responsible for ensuring that the levees they own are maintained to their original design level and condition. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove that the levee meets design, operation, and maintenance standards for protection against the 1% annual probability (100-year) flood.

Calculated Risk Priority Index for Flooding

Based on historical information and the HAZUS-MH flooding analysis results, the probability of flooding in Union County is likely. According to the Risk Priority Index (RPI), flooding ranked as the number seven hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
3	x	2	=	6

Calculated Risk Priority Index for Dam and Levee Failure

Based on operation and maintenance requirements and local knowledge of the dams in Union County, the probability of failure is possible. However, if a high hazard dam were to fail, the magnitude and severity of the damage could be great. The warning time and duration of the dam failure event would be very short. According to the RPI, dam and levee failure ranked as the number seven hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
3	x	4	=	12

HAZUS-MH Analysis Using 100-Year DFIRM Boundary and County Parcels

HAZUS-MH generated the flood depth grid for a 100-year return period and made calculations by clipping the USGS One-third-arc-second (~10m) DEM to the DFIRM boundary. Next, HAZUS-MH utilized a user-defined analysis of Union County with site-specific parcel data provided by the county.

HAZUS-MH estimates the 100-year flood would damage 529 buildings at an estimated value of \$37.4 million. The total estimated numbers of damaged buildings are given in Table 4-23. Figure 4-6 depicts the Union County parcel points that fall within the 100-year floodplain. Figure 4-7 highlight damaged buildings within the floodplain areas in Anna, Dongola, Jonesboro, and Mill Creek. The Assessor records often do not distinguish parcels by occupancy class if the parcels are not taxable. For purposes of analysis, the total number of buildings and the assessed values for government, religious/non-profit, and education should be lumped together as exempt.

Table 4-23: Union County HAZUS-MH Analysis Building Loss (100-Year Flood)

General Occupancy	Total Damaged Buildings	Building Loss (X 1000)
Agricultural	197	\$17,193
Commercial	30	\$2,152
Exempt	4	\$3,105
Industrial	0	\$0
Residential	289	\$14,928
Total	529	\$37,378

Figure 4-6: Union County Buildings in Floodplain (100-Year Flood)

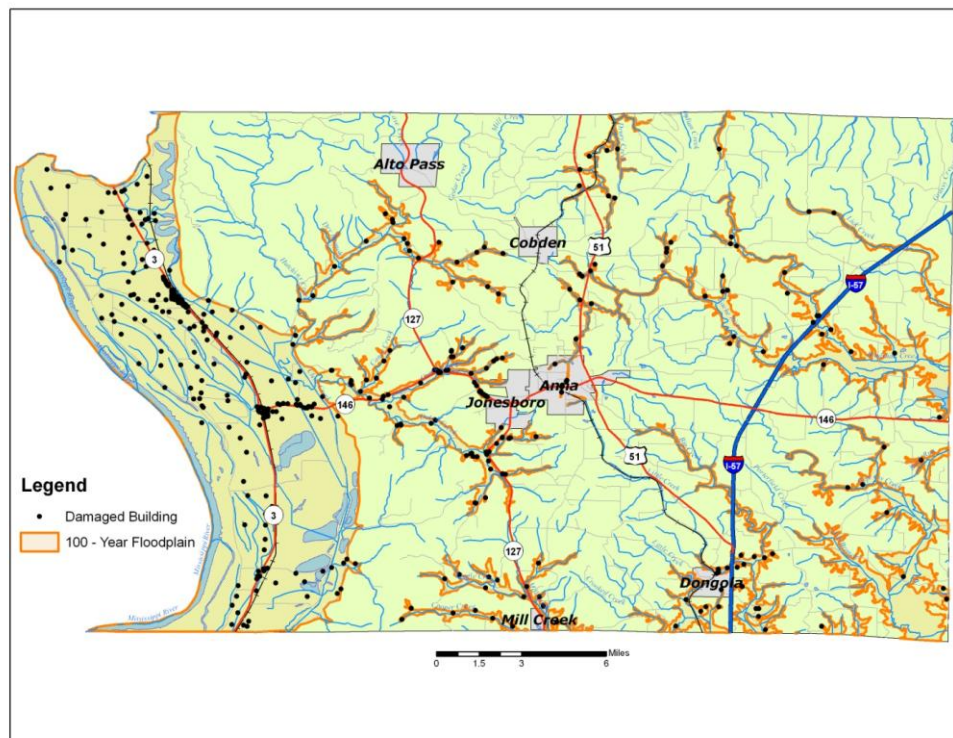
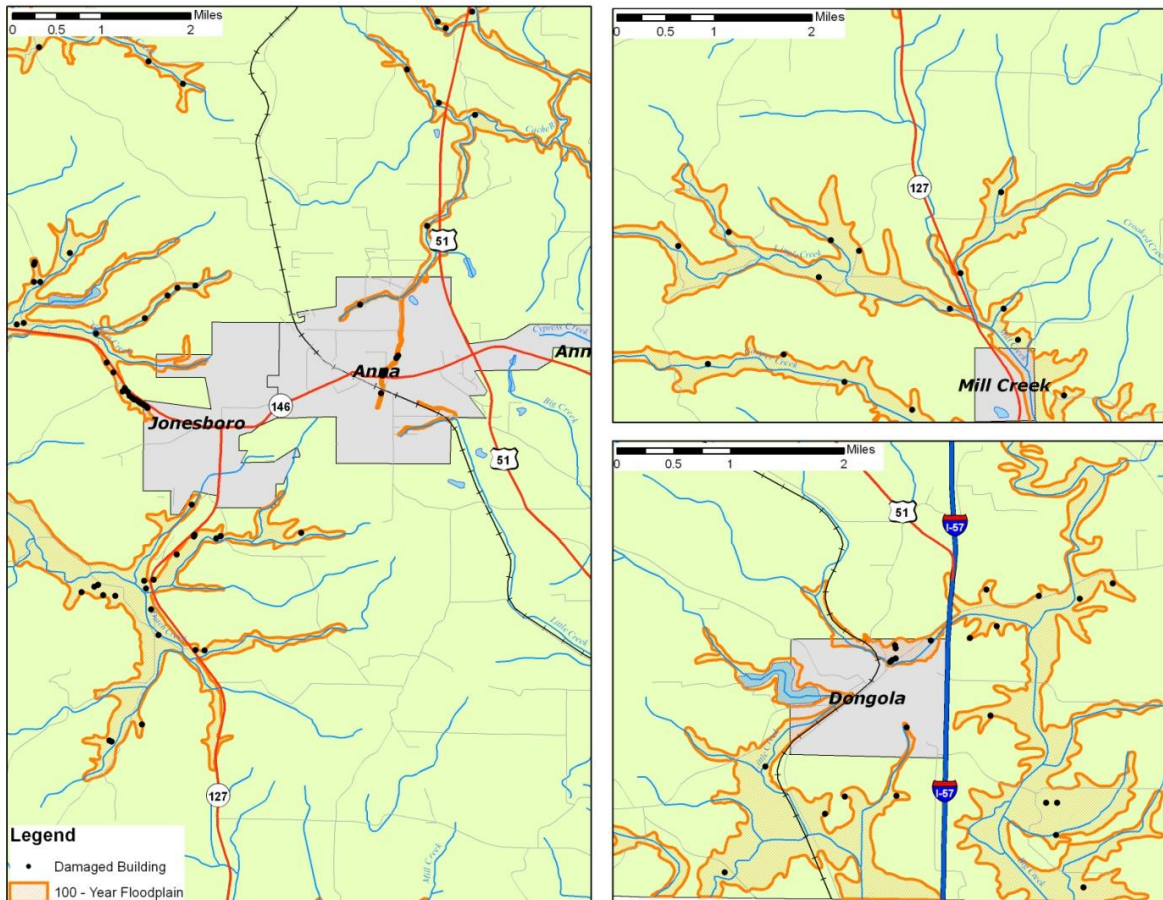


Figure 4-7: Buildings in Floodplain (100-Year Flood) near Anna, Dongola, Jonesboro, and Mill Creek



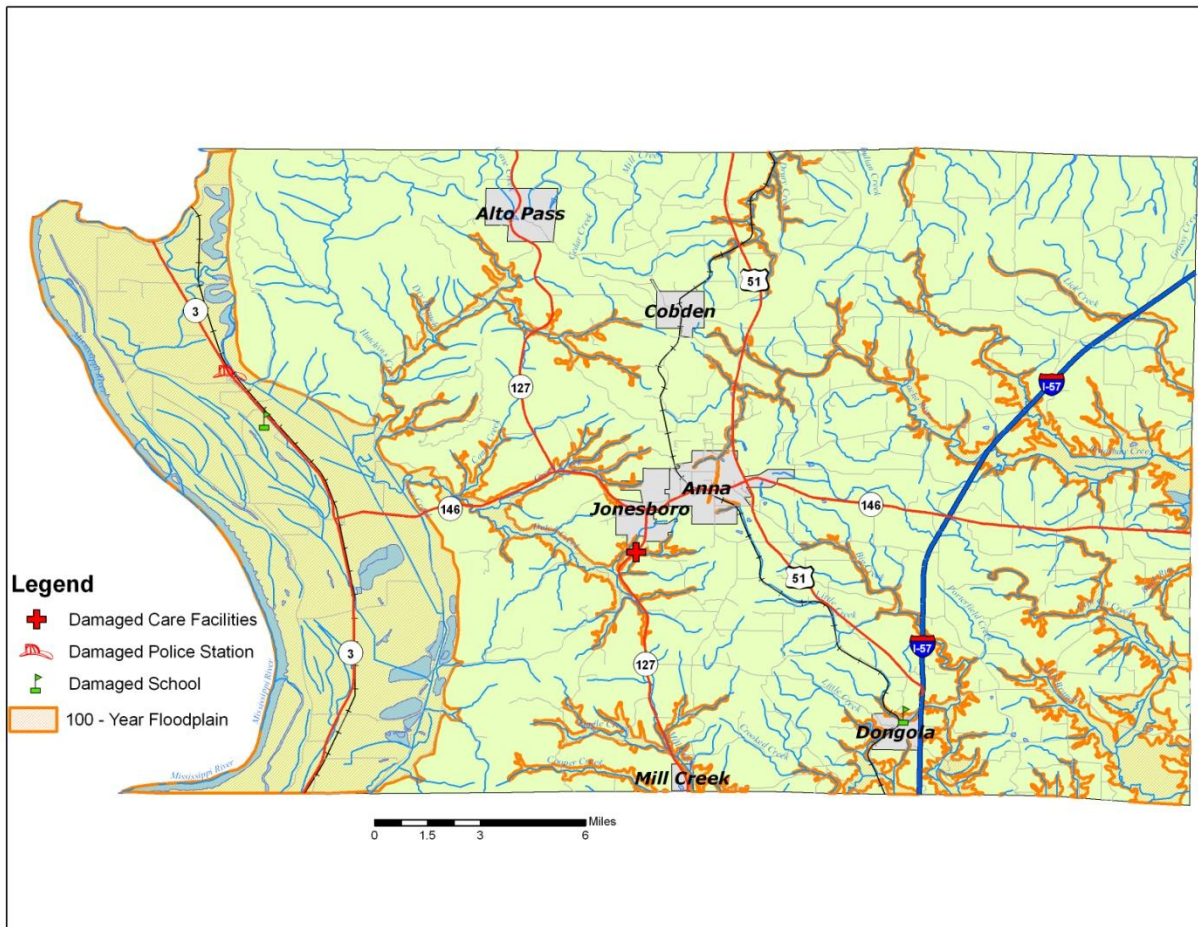
Essential Facilities

An essential facility will encounter many of the same impacts as other buildings within the flood boundary. These impacts can include structural failure, extensive water damage to the facility and loss of facility functionality (e.g., a damaged police station will no longer be able to serve the community). A complete list of all the critical facilities, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

A list of the essential facilities subject flooding is given in Table 4-24. A map of essential facilities potentially at risk to flooding is shown in Figure 4-8.

Table 4-24: Damaged Essential Facilities

Facility Name
Ware-Wolf Lake Fire Department
Jonesboro Healthcare & Rehabilitation Center
Shawnee Jr and Sr High School
Dongola Elementary and High School

Figure 4-8 Boundary of 100-Year Flood Overlaid with Essential Facilities

Infrastructure

The types of infrastructure that could be impacted by a flood include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available for this plan, it is important to emphasize that any number of these items could become damaged in the event of a flood. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could fail or become impassable, causing a traffic risk.

Vulnerability Analysis for Flash Flooding

Flash flooding could affect any low lying location within this jurisdiction; therefore, a significant portion of the county's population and buildings are vulnerable to a flash flood. These structures can expect the same impacts as discussed in a riverine flood.

Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Vulnerability Analysis for Dam and Levee Failure

An EAP is required to assess the effect of dam failure on these communities. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation and maintenance standards for protection against the 1% annual probability flood.

Vulnerability to Future Assets/Infrastructure for Flooding

Flash flooding may affect nearly any location within the county; therefore all buildings and infrastructure are vulnerable to flash flooding. Currently, the municipality zoning boards review new development for compliance with local zoning ordinances. The Union County Emergency Management Agency administers the floodplain for the county. At this time no construction is planned within the area of the 100-year floodplain. Therefore, there is no new construction, which will be vulnerable to a 100-year flood.

Vulnerability to Future Assets/Infrastructure for Dam and Levee Failure

Municipal Planning Departments/Commissions review new developments for compliance with local zoning ordinances.

Analysis of Community Development Trends

Areas with recent development within the county may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible, which can cause the back-up of water, sewage, and debris into homes and basements, causing structural and mechanical damage as well as creating public health hazards and unsanitary conditions. Controlling floodplain development is the key to reducing flood-related damages.

4.4.3 Earthquake Hazard

Hazard Definition for Earthquake Hazard

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, plate tectonics has shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. At their boundaries, the plates typically are locked together and unable to release the accumulating energy. When this energy grows strong enough, the plate boundary breaks free and causes the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates, as is the case for seismic zones in the Midwestern United States. The most seismically active area in the Midwest U.S. is the New Madrid Seismic Zone. Scientists have learned that the New Madrid fault system may not be the only fault system in the Central U.S. capable of producing damaging earthquakes. The Wabash Valley fault system in Illinois and Indiana manifests evidence of large earthquakes in its geologic history, and there may be other, as yet unidentified, faults that could produce strong earthquakes.

Ground shaking from strong earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated materials and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage. Magnitude measures the energy released at the source of the earthquake. Magnitude is determined from measurements on seismographs, and a single earthquake will have a single magnitude to quantify its strength. Earthquake intensity measures the strength of shaking produced by the earthquake at a certain location. Intensity is determined from effects on people, human structures, and the natural environment, and a single earthquake will have a wide range of intensity values at different locations around the epicenter. Table 4-25 is a description of earthquake intensity using an abbreviated Modified Mercalli Intensity scale, and Table 4-26 lists earthquake magnitudes and their corresponding intensities.

(Source: http://earthquake.usgs.gov/learning/topics/mag_vs_int.php)

Table 4-25: Abbreviated Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

Mercalli Intensity	Description
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Table 4-26: Earthquake Magnitude vs. Modified Mercalli Intensity Scale

Earthquake Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 - 3.0	I
3.0 - 3.9	II - III
4.0 - 4.9	IV - V
5.0 - 5.9	VI - VII
6.0 - 6.9	VII - IX
7.0 and higher	VIII or higher

Historical Earthquakes that have Affected Union County

Numerous instrumentally measured earthquakes have occurred in Illinois. In the past few decades, with many precise seismographs positioned across Illinois, measured earthquakes have varied in magnitude from very low microseismic events of $M=1-3$ to larger events up to $M=5.4$. Microseismic events are usually only detectable by seismographs and rarely felt by anyone. The most recent earthquake in Southern Illinois—as of the date of this report—occurred on September 6, 2009 at 2:46:20 local time about 10 km (6 miles) west-northwest of Mount Carmel, IL and measured 2.4 in magnitude.

The consensus of opinion among seismologists working in the Midwest is that a magnitude 5.0 to 5.5 event could occur virtually anywhere at any time throughout the region. Earthquakes occur in Illinois all the time, although damaging quakes are very infrequent. Illinois earthquakes causing minor damage occur on average every 20 years, although the actual timing is extremely variable. Most recently, a magnitude 5.2 earthquake shook southeastern Illinois on April 18, 2008, causing minor damage in the Mt Carmel, IL area. Earthquakes resulting in more serious damage have occurred about every 70 to 90 years.

First on the list of historical earthquakes that have affected Illinois and first on the list on continuing earthquake threats at present and into the future is seismic activity on the New Madrid Seismic Zone of southeastern Missouri. On December 16, 1811 and January 23 and February 7 of 1812, three earthquakes struck the central U.S. with magnitudes estimated to be 7.5-8.0. These earthquakes caused violent ground cracking and volcano-like eruptions of sediment (*sand blows*) over an area of $>10,500 \text{ km}^2$, and uplift of a 50 km by 23 km zone (the Lake County uplift). The shaking collapsed scaffolding on the Capitol in Washington, D.C., and was felt over a total area of over 10 million km^2 (the largest felt area of any historical

earthquake). Of all the historical earthquakes that have struck the U.S., an 1811-style event would do the most damage if it recurred today.

The New Madrid earthquakes are especially noteworthy because the seismic zone is in the center of the North American Plate. Such intraplate earthquakes are felt, and do damage, over much broader areas than comparable earthquakes at plate boundaries. The precise driving force responsible for activity on the New Madrid seismic zone is not known, but most scientists infer that it is compression transmitted across the North American Plate. That compression is focused on New Madrid because it is the site of a Paleozoic structure—the Reelfoot Rift—which is a zone of weakness in the crust.

The United States Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) at the University of Memphis estimate the probability of a repeat of the 1811–1812 type earthquakes (magnitude 7.5–8.0) is 7%–10% over the next 50 years (*USGS Fact Sheet 2006-3125*.) Frequent large earthquakes on the New Madrid seismic zone are geologically puzzling because the region shows relatively little deformation. Three explanations have been proposed: 1) recent seismological and geodetic activity is still a short-term response to the 1811–12 earthquakes; 2) activity is irregular or cyclic; or 3) activity began only in the recent geologic past. There is some dispute over how often earthquakes like the 1811–12 sequence occur. Many researchers estimate a recurrence interval of between 550 and 1100 years; other researchers suggest that either the magnitude of the 1811–12 earthquakes have been over-stated, or else the actual frequency of these events is less. It is fair to say, however, that even if the 1811–12 shocks were just magnitude ~7 events, they nonetheless caused widespread damage and would do the same if another such earthquake or earthquake sequence were to strike today.

[Above: New Madrid earthquakes and seismic zone modified from N. Pinter, 1993, Exercises in Active Tectonic history adapted from *Earthquake Information Bulletin*, 4(3), May-June 1972. <http://earthquake.usgs.gov/regional/states/illinois/history.php>]

The earliest reported earthquake in Illinois was in **1795**. This event was felt at Kaskaskia, IL for a minute and a half and was also felt in Kentucky. At Kaskaskia, subterranean noises were heard. Due to the sparse frontier population, an accurate location is not possible, and the shock may have actually originated outside the state.

An intensity VI-VII earthquake occurred on **April 12, 1883**, awakening several people in Cairo, IL. One old frame house was significantly damaged, resulting in minor injuries to the inhabitants. This is the only record of injury in the state due to earthquakes.

On **October 31, 1895** a large M6.8 occurred at Charleston, Missouri, just south of Cairo. Strong shaking caused eruptions of sand and water at many places along a line roughly 30 km (20 mi) long. Damage occurred in six states, but most severely at Charleston, with cracked walls, windows shattered, broken plaster, and chimneys fallen. Shaking was felt in 23 states from Washington, D.C. to Kansas and from southernmost Canada to New Orleans, LA.

A Missouri earthquake on **November 4, 1905**, cracked walls in Cairo. Aftershocks were felt over an area of 100,000 square miles in nine states. In Illinois, it cracked the wall of the new education building in Cairo and a wall at Carbondale, IL.

Among the largest earthquakes occurring in Illinois was the **May 26, 1909** shock, which knocked over many chimneys at Aurora. It was felt over 500,000 square miles and strongly felt in Iowa and Wisconsin. Buildings swayed in Chicago where there was fear that the walls would collapse. Just under two months later, a second Intensity VII earthquake occurred on **July 18, 1909**, damaged chimneys in Petersburg, IL, Hannibal, MO, and Davenport, IA. Over twenty windows were broken, bricks loosened and plaster cracked in the Petersburg area. This event was felt over 40,000 square miles.

On **November 7, 1958**, a shock along the Indiana border resulted in damage at Bartelso, Dale and Maunie, IL. Plaster cracked and fell, and a basement wall and floor were cracked.

On **August 14, 1965**, a sharp but local shock occurred at Tamms, IL, a town of about 600 people. The magnitude 5 quake damaged chimneys, cracked walls, knocked groceries from the shelves, and muddied the water supply. Thunderous earth noises were heard. This earthquake was only felt within a 10 mile radius of Tamms, in communities such as Elco, Unity, Olive Branch, and Olmstead, IL. Six aftershocks were felt.

An earthquake of Intensity VII occurred on **November 9, 1968**. This magnitude 5.3 shock was felt over an area of 580,000 square miles in 23 states. There were reports of people in tall buildings in Ontario and Boston feeling the shock. Damage consisted of bricks being knocked from chimneys, broken windows, toppled television antenna, and cracked plaster. There were scattered reports of cracked foundations, fallen parapets, and overturned tombstones. Chimney damage was limited to buildings 30 to 50 years old. Many people were frightened. Church bells rang at Broughton and several other towns. Loud rumbling earthquake noise was reported in many communities.

Dozens of other shocks originating in Missouri, Arkansas, Kansas, Nebraska, Tennessee, Indiana, Ohio, Michigan, Kentucky, and Canada have been felt in Illinois without causing damage. There have been three earthquakes slightly greater than magnitude 5.0 and Intensity level VII which occurred in 1968, 1987 and 2008 and that were widely felt throughout southern Illinois and the midcontinent.

Above text adapted from <http://earthquake.usgs.gov/regional/states/illinois/history.php> and from *Seismicity of the United States, 1568-1989 (Revised)*, C.W. Stover and J.L. Coffman, U.S. Geological Survey Professional Paper 1527, United States Government Printing Office, Washington: 1993.

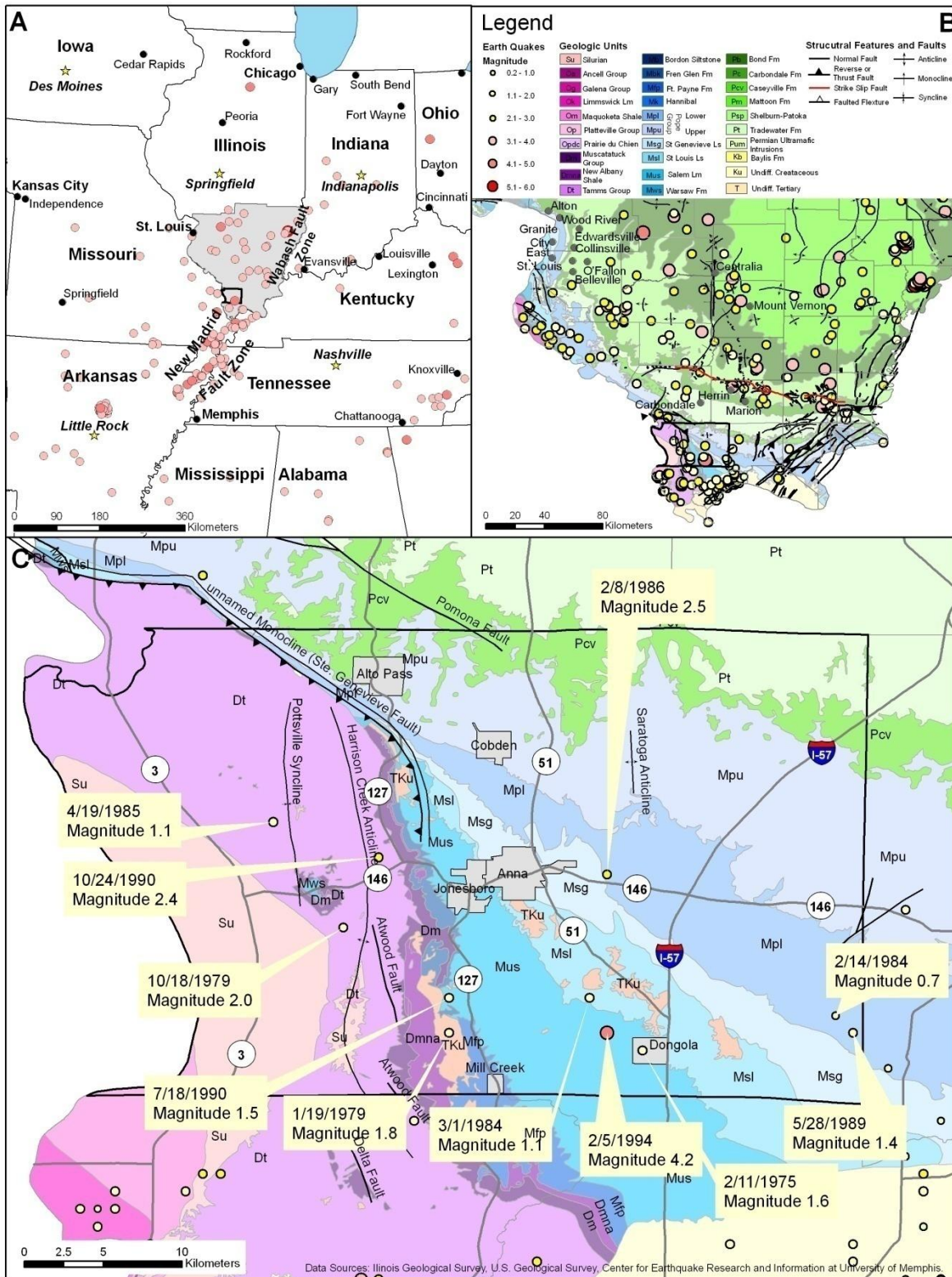
Geographic Location for Earthquake Hazard

Union County occupies a region susceptible to earthquakes. Regionally, the two most significant zones of seismic activity are the New Madrid Seismic Zone and the Wabash Valley Fault System. The epicenters of eleven small earthquakes (M1.1–4.2) have been recorded in Union County since 1974 (Figure 4-9). The geologic mechanism related to the minor earthquakes is poorly understood. Return periods for large earthquakes within the New Madrid System are

estimated to be ~500–1000 years; moderate quakes between magnitude 5.5 and 6.0 can recur within approximately 150 years or less. The Wabash Valley Fault System extends nearly the entire length of southern Illinois and has the potential to generate an earthquake of sufficient strength to cause damage between St. Louis, MO and Indianapolis, IN. The USGS and the Center for Earthquake Research and Information estimate the probability of a repeat of the 1811–1812 type earthquakes (magnitude 7.5–8.0) at 7%–10% and the probability of a magnitude 6.0 or larger at 25%–40% within the next 50 years.

Figure 4-9 depicts the following: a) Location of notable earthquakes in the Illinois region with inset of Union County; b) Generalized geologic bedrock map with earthquake epicenters, geologic structures, and inset of Union County; c) Geologic and earthquake epicenter map of Union County.

Figure 4-9 a, b, c: Union County Earthquakes



Hazard Extent for Earthquake Hazard

The extent of the earthquake is countywide.

Calculated Risk Priority Index for Earthquake Hazard

Based on historical information as well as current USGS and SIU research and studies, future earthquakes in Union County are possible. According to the RPI, earthquake is ranked as the number two hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
2	x	8	=	16

Vulnerability Analysis for Earthquake Hazard

This hazard could impact the entire jurisdiction equally; therefore, the entire county's population and all buildings are vulnerable to an earthquake and can expect the same impacts within the affected area. To accommodate this risk this plan will consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities are vulnerable to earthquakes. A critical facility would encounter many of the same impacts as any other building within the county. These impacts include structural failure and loss of facility functionality (e.g. damaged police station will no longer be able to serve the community). A complete list of all of the critical facilities, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

Table 4-9 shows building exposure for the entire county. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure and loss of building function, which could result in indirect impacts (e.g. damaged homes will no longer be habitable, causing residence to seek shelter).

Infrastructure

During an earthquake, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since a full inventory of infrastructure is not available for this plan, it is important to emphasize that any number of these items could become damaged in the event of an earthquake. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g. loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could fail or become impassable causing

risk to traffic. Typical scenarios are described to gauge the anticipated impacts of earthquakes in the county in terms of number and types of buildings and infrastructure.

The SIU-Polis team reviewed existing geological information and recommendations for earthquake scenarios. Three earthquake scenarios—two based on USGS modeled scenarios and one based on deterministic scenarios were developed to provide a reasonable basis for earthquake planning in Union County. The two USGS analyses were a M7.7 event on the New Madrid fault zone and M7.1 earthquake on the Wabash Valley Seismic Zone. Shake maps provided by FEMA were used in HAZUS-MH to estimate losses for Union County based on these events. The final scenario was a Moment Magnitude of 5.5 with the epicenter located in Union County. Note that a deterministic scenario, in this context, refers to hazard or risk models based on specific scenarios without explicit consideration of the probability of their occurrences. This scenario was selected based upon a rupture of the Ste. Genevieve Fault located just northwest of Anna and Jonesboro, IL that presents a realistic earthquake scenario for planning purposes.

Modeling a deterministic scenario requires user input for a variety of parameters. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. Illinois Geologic Survey provided a NEHRP (National Earthquake Hazards Reduction Program) soil classification map for southern Illinois (Bauer and Su, 2007). NEHRP soil classifications portray the degree of shear-wave amplification that can occur during ground shaking.

Earthquake hypocenter depths in southern Illinois range from less than 1.0 to ~25.0 km. The average hypocenter depth, ~10.0 km, was used for the deterministic earthquake scenario. For this scenario type HAZUS-MH also requires the user to define an attenuation function. To maintain consistency with the USGS's (2006) modeling of strong ground motion in the central United States, the Toro et al. (1997) attenuation function was used for the deterministic earthquake scenario.

The building losses are subdivided into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake

Results for 7.7 Magnitude New Madrid Earthquake Scenario

The results of the 7.7 New Madrid Earthquake are depicted in Table 4-27, Table 4-28, and Figure 4-10. HAZUS-MH estimates that approximately 995 buildings will be at least moderately damaged. This is more than 13% of the total number of buildings in the region.

The total building related losses totaled \$93.38 million; 6% of the estimated losses were related to the business interruption of the region. Large losses were sustained by the residential occupancies, which comprised more than 57% of the total loss.

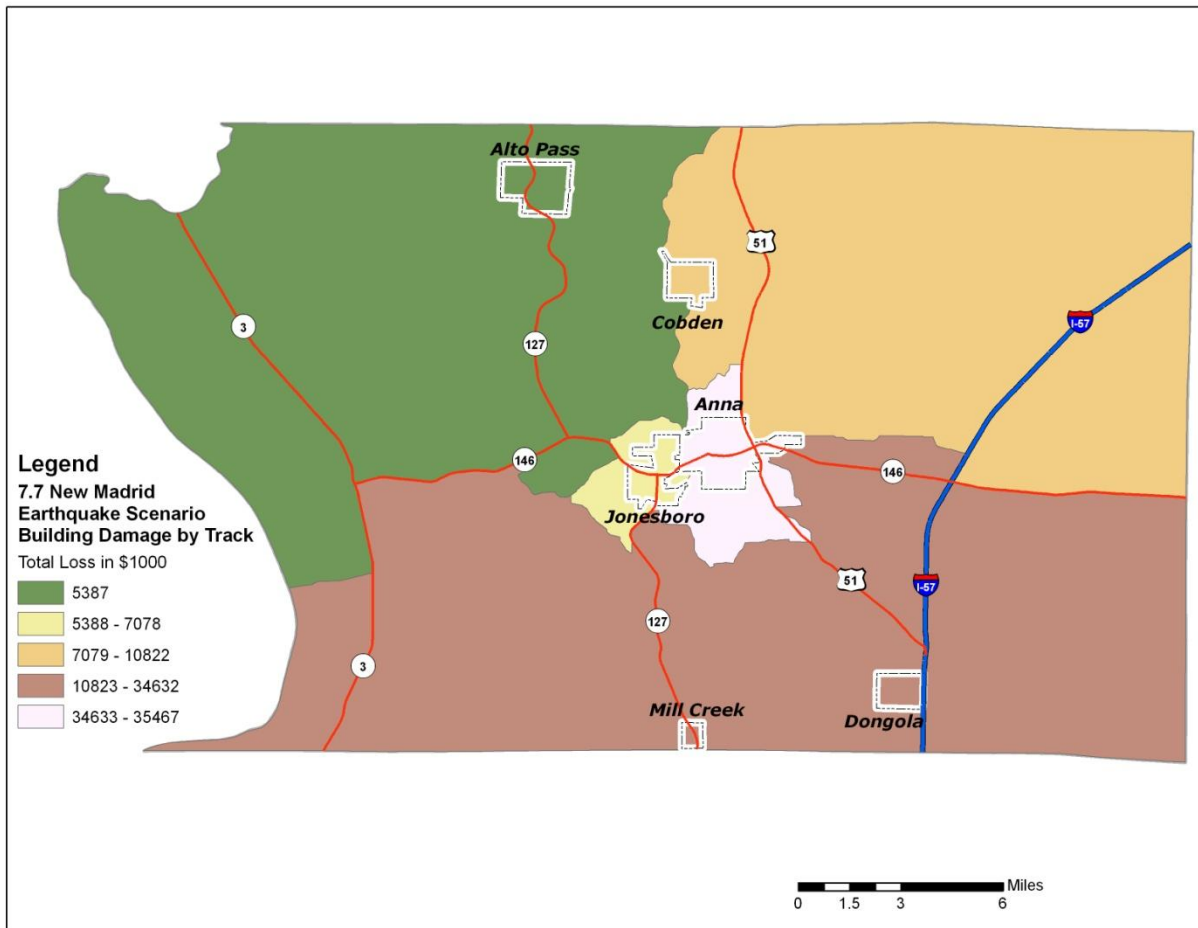
Table 4-27: New Madrid Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	5	0.11	2	0.12	1	0.17	0	0.23	0	0.33
Commercial	87	1.80	28	1.66	15	1.83	4	2.03	1	2.86
Education	4	0.08	1	0.08	1	0.09	0	0.12	0	0.15
Government	9	0.20	2	0.14	1	0.12	0	0.11	0	0.15
Industrial	11	0.24	4	0.24	3	0.34	1	0.49	0	0.79
Other Residential	703	14.62	421	25.45	350	44.09	102	56.58	11	48.67
Religion	10	0.20	3	0.19	2	0.19	0	0.20	0	0.27
Single Family	3,982	82.76	1,194	72.12	422	53.16	72	40.24	10	46.79
Total	4,812		1,656		793		180		22	

Table 4-28: New Madrid Scenario-Building Economic losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.14	2.19	0.07	0.14	2.54
	Capital-Related	0.00	0.06	1.32	0.04	0.04	1.47
	Rental	0.60	0.34	0.65	0.02	0.06	1.67
	Relocation	0.07	0.02	0.05	0.00	0.02	0.16
	Subtotal	0.67	0.56	4.21	0.13	0.25	5.83
Capital Stock Losses							
	Structural	2.98	1.20	1.13	0.29	0.81	6.41
	Non_Structural	20.12	10.23	10.49	2.36	4.03	47.23
	Content	12.57	4.53	10.32	1.88	3.83	33.12
	Inventory	0.00	0.00	0.20	0.47	0.13	0.80
	Subtotal	35.67	15.95	22.13	5.00	8.80	87.55
	Total	36.34	16.51	26.35	5.13	9.05	93.38

Figure 4-10: New Madrid Valley Scenario-Building Economic Losses in Thousands of Dollars



New Madrid Earthquake Scenario—Essential Facility Losses

Before the earthquake, the region had 157 care beds available for use. On the day of the earthquake, the model estimates that only 16 care beds (0%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 52% of the beds will be back in service. By day 30, 75% will be operational.

Results for 7.1 Magnitude Wabash Valley Earthquake Scenario

The results of the 7.1 Wabash Valley Earthquake are depicted in Table 4-29, Table 4-30, and Figure 4-11. HAZUS-MH estimates that approximately 2 building will be at least moderately damaged.

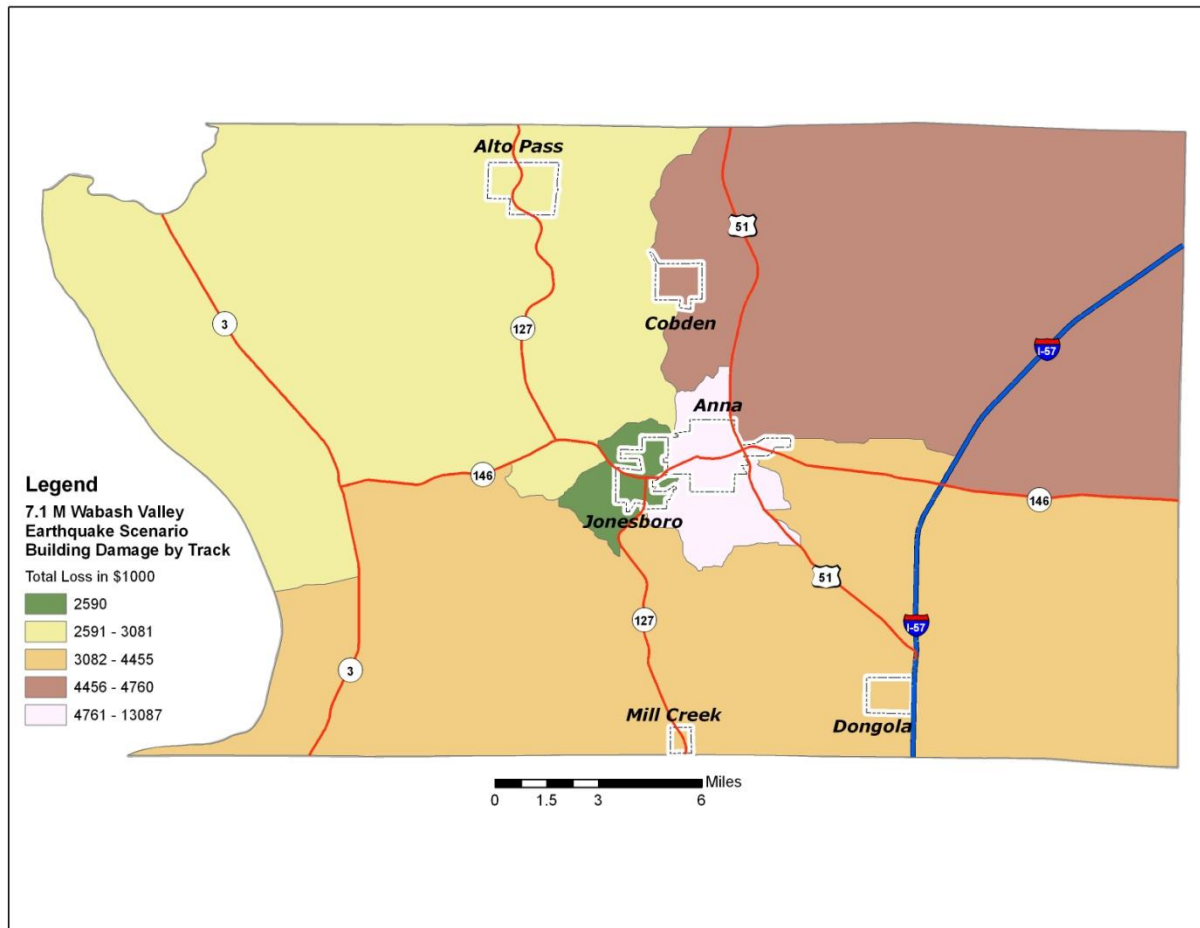
The total building related losses totaled \$27.97 million; 0% of the estimated losses were related to the business interruption of the region. Large losses were sustained by the residential occupancies, which comprised more than 53% of the total loss.

4-29: Wabash Valley Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	9	0.12	0	0.13	0	0.16	0	0.00	0	0.00
Commercial	132	1.78	1	1.82	0	2.08	0	0.00	0	0.00
Education	6	0.08	0	0.11	0	0.12	0	0.00	0	0.00
Government	13	0.17	0	0.19	0	0.20	0	0.00	0	0.00
Industrial	19	0.25	0	0.24	0	0.30	0	0.00	0	0.00
Other Residential	1,565	21.09	20	51.81	1	52.09	0	0.00	0	0.00
Religion	15	0.20	0	0.25	0	0.29	0	0.00	0	0.00
Single Family	5,662	76.29	18	45.45	1	44.77	0	0.00	0	0.00
Total	7,421		39		2		0		0	

Table 4-30: Wabash Valley Scenario-Building Economic losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.01	0.00	0.00	0.01
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.01	0.00	0.00	0.02
Capital Stock Losses							
	Structural	0.01	0.01	0.01	0.00	0.00	0.03
	Non_Structural	5.35	3.36	3.93	0.94	1.51	15.09
	Content	4.30	1.77	4.13	0.76	1.57	12.52
	Inventory	0.00	0.00	0.08	0.18	0.05	0.32
	Subtotal	9.65	5.14	8.15	1.88	3.13	27.95
	Total	9.65	5.14	8.16	1.88	3.13	27.97

Figure 4-11: Wabash Valley Scenario-Building Economic Losses in Thousands of Dollars

Wabash Valley Scenario—Essential Facility Losses

Before the earthquake, the region had 157 care beds available for use. On the day of the earthquake, the model estimates that only 86 care beds (51.0%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 97% of the beds will be back in service. By day 30, 100% will be operational.

Results for 5.5 Magnitude Earthquake in Union County

The results of the arbitrary 5.5 magnitude earthquake within Union County are depicted in Tables 4-31 and 4-32 and Figure 4-12. HAZUS-MH estimates that approximately 1,106 buildings will be at least moderately damaged. This is more than 15% of the total number of buildings in the region. It is estimated that 36 buildings will be damaged beyond repair.

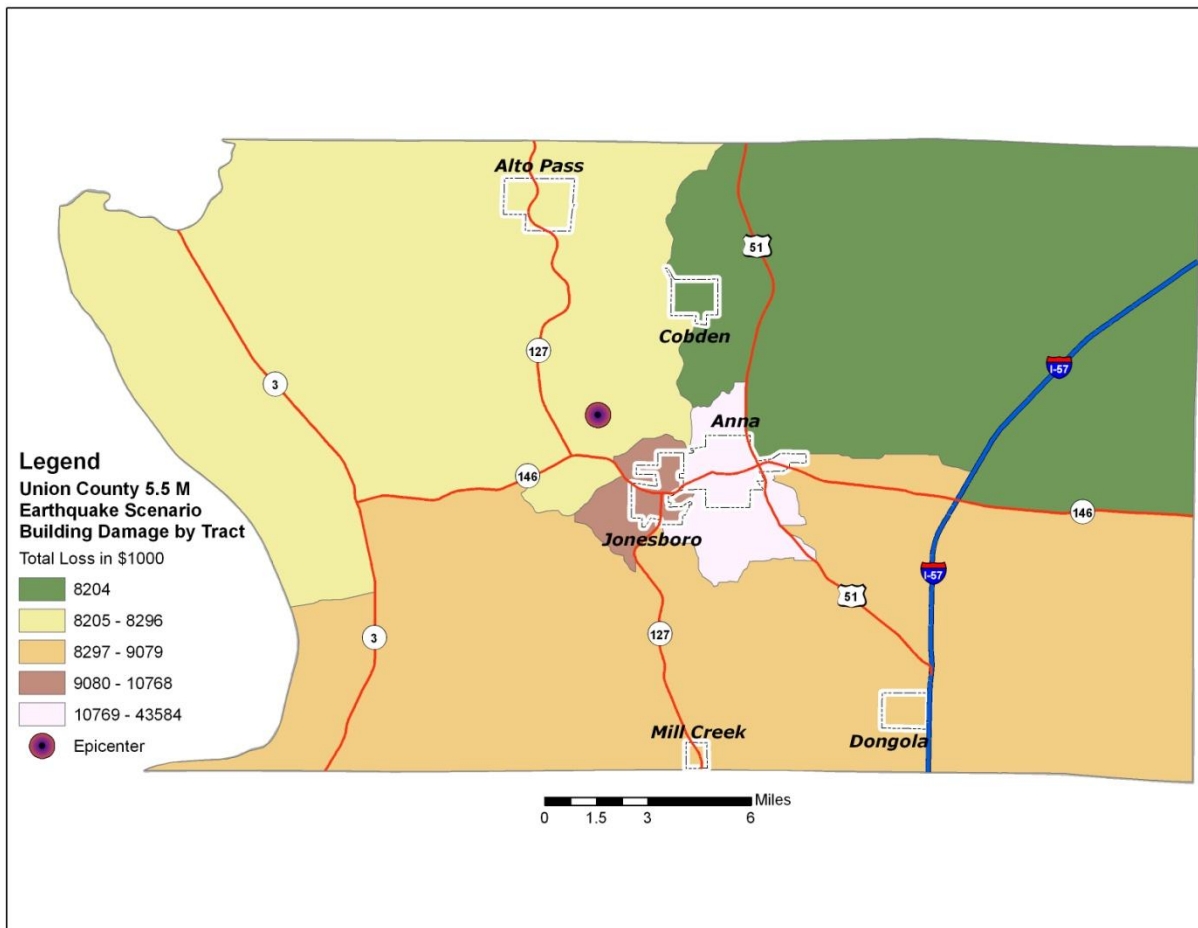
The total building related losses totaled \$79.93 million; 13% of the estimated losses were related to the business interruption of the region. Large losses were sustained by the residential occupancies, which comprised more than 55% of the total loss.

Table 4-31: Union County 5.5M Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	5	0.12	2	0.10	1	0.16	0	0.24	0	0.19
Commercial	74	1.64	30	1.61	22	2.46	6	3.55	1	3.12
Education	3	0.07	1	0.07	1	0.11	0	0.17	0	0.20
Government	7	0.16	3	0.15	2	0.24	1	0.33	0	0.40
Industrial	11	0.23	4	0.22	3	0.37	1	0.55	0	0.40
Other Residential	832	18.45	386	20.87	307	34.57	59	32.28	4	10.31
Religion	8	0.18	4	0.19	2	0.27	1	0.43	0	0.47
Single Family	3,568	79.14	1,419	76.79	548	61.82	114	62.45	31	84.91
Total	4,509		1,848		887		182		37	

Table 4-32: Union County 5.5M Scenario-Building Economic Losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.33	4.07	0.06	0.29	4.75
	Capital-Related	0.00	0.14	2.41	0.04	0.07	2.66
	Rental	0.90	0.87	1.11	0.02	0.11	3.01
	Relocation	0.10	0.03	0.10	0.00	0.04	0.27
	Subtotal	1.00	1.37	7.69	0.12	0.51	10.68
Capital Stock Losses							
	Structural	4.19	2.03	2.08	0.29	1.17	9.77
	Non_Structural	16.76	9.24	8.67	1.44	3.59	39.71
	Content	6.65	2.84	6.34	1.07	2.41	19.32
	Inventory	0.00	0.00	0.12	0.25	0.07	0.44
	Subtotal	27.61	14.12	17.22	3.06	7.24	69.25
	Total	28.61	15.48	24.91	3.18	7.75	79.93

Figure 4-12: Union County 5.5M Scenario-Building Economic Losses in Thousands of Dollars

Arbitrary Earthquake Scenario—Essential Facility Losses

Before the earthquake, the region had 157 care beds available for use. On the day of the earthquake, the model estimates that only 8 care beds (6.0%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 40.0% of the beds will be back in service. By day 30, 71.0% will be operational.

Vulnerability to Future Assets/Infrastructure for Earthquake Hazard

New construction, especially critical facilities, will accommodate earthquake mitigation design standards.

Analysis of Community Development Trends

Community development will occur outside of the low-lying areas in floodplains with a water table within five feet of grade which are susceptible to liquefaction. Furthermore, Union County will continue to provide training to county officials, implement public education, and institute leaders who are proactive in mapping and studying the risks of earthquakes in the county.

4.4.4 Thunderstorm Hazard

Hazard Definition for Thunderstorm Hazard

Severe thunderstorms are defined as thunderstorms with one or more of the following characteristics: strong winds, large damaging hail, and frequent lightning. Severe thunderstorms most frequently occur in Illinois in the spring and summer months and in the late afternoon or evening, but can occur any month of the year at any time of day. A severe thunderstorm's impacts can be localized or can be widespread in nature. A thunderstorm is classified as severe when it meets one of more of the following criteria:

- Hail of diameter 0.75 inches or higher
- Frequent and dangerous lightning
- Wind speeds equal to or greater than 58 mph

Hail

Hail can be a product of a strong thunderstorm. Hail usually falls near the center of a storm; however strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, resulting in a broader distribution. Hailstones range from pea-sized to baseball-sized, but hailstones larger than softballs have been reported on rare occasions.

Lightning

Lightning is a discharge of electricity from a thunderstorm. Lightning is often perceived as a minor hazard, but in reality lightning causes damage to many structures and kills or severely injures numerous people in the United States each year.

Severe Winds (Straight-Line Winds)

Straight-line winds from thunderstorms are a fairly common occurrence across Illinois. Straight-line winds can cause damage to homes, businesses, power lines, and agricultural areas and may require temporary sheltering of individuals who are without power for extended periods of time.

Previous Occurrences for Thunderstorm Hazard

The NCDC database reported 40 hailstorms in Union County since 1963. These storms have been attributed with 20 injuries and \$50,000 in property damage. Hailstorms occur nearly every year in the late spring and early summer months. The most recent significant occurrence was in April 2006 when golf ball size hail fell along State Route 127 two miles north of Jonesboro and quarter size hail fell in Cobden.

Union County hailstorms are listed in 4-33; additional details for NCDC events are included in Appendix D.

Table 4-33: Union County Hailstorms*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Union	4/22/1963	Hail	0.75 in.	0	0	0	0
Union	7/31/1967	Hail	2.75 in.	0	0	0	0
Union	6/22/1969	Hail	1.25 in.	0	0	0	0
Union	8/9/1969	Hail	1.75 in.	0	0	0	0
Union	4/13/1972	Hail	0.75 in.	0	0	0	0
Union	6/28/1972	Hail	0.75 in.	0	0	0	0
Union	7/5/1975	Hail	0.75 in.	0	0	0	0
Union	9/25/1977	Hail	2.00 in.	0	0	0	0
Union	4/3/1984	Hail	0.75 in.	0	0	0	0
Union	5/14/1986	Hail	0.75 in.	0	0	0	0
Union	4/3/1989	Hail	1.75 in.	0	0	0	0
Union	4/23/1989	Hail	0.75 in.	0	0	0	0
Union	4/9/1991	Hail	0.75 in.	0	0	0	0
Union	4/9/1991	Hail	0.75 in.	0	0	0	0
Reynoldsville	9/2/1993	Hail	0.75 in.	0	0	0	1K
Jonesboro	5/13/1995	Hail	1.00 in.	0	0	0	0
Jonesboro	5/16/1995	Hail	0.75 in.	0	0	0	0
Ware	5/16/1995	Hail	0.75 in.	0	0	0	0
Jonesboro	5/17/1995	Hail	1.00 in.	0	20	0	0
Cobden	6/13/1997	Hail	0.88 in.	0	0	0	0
Jonesboro	1/3/2000	Hail	0.88 in.	0	0	0	0
Cobden	5/23/2000	Hail	1.75 in.	0	0	50K	0
Jonesboro	5/23/2000	Hail	1.75 in.	0	0	0	0
Dongola	8/18/2001	Hail	0.75 in.	0	0	0	0
Alto Pass	5/25/2002	Hail	0.88 in.	0	0	0	0
Jonesboro	5/25/2002	Hail	1.00 in.	0	0	0	0
Anna	4/4/2003	Hail	0.75 in.	0	0	0	0
Cobden	4/29/2003	Hail	1.00 in.	0	0	0	0
Cobden	4/29/2003	Hail	1.25 in.	0	0	0	0
Anna	4/29/2003	Hail	1.25 in.	0	0	0	0
Alto Pass	3/20/2004	Hail	0.88 in.	0	0	0	0
Cobden	3/20/2004	Hail	1.00 in.	0	0	0	0
Anna	3/30/2005	Hail	0.75 in.	0	0	0	0
Mt Pleasant	3/30/2005	Hail	1.00 in.	0	0	0	0
Anna	3/11/2006	Hail	0.75 in.	0	0	0	0
Jonesboro	4/2/2006	Hail	1.75 in.	0	0	0	0
Jonesboro	4/2/2006	Hail	1.75 in.	0	0	0	0

Source: NCDC

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature

and may not match the final assessment of economic and property losses related to a given weather event.

The NCDC database identified 66 wind storms reported since 1960. On multiple occasions in the past 50 years trees have been uprooted by severe winds in Union County. These storms have been attributed with one death, two injuries and nearly a \$1.0 million in property damage in Union and adjacent counties.

As shown in Table 4-34, wind storms have historically occurred year-round with the greatest frequency and damage in April through August.

Table 4-34: Union County Wind Storms*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Union	10/22/1996	High Wind	0 kts.	0	0	28K
Union	4/30/1997	High Wind	52 kts.	0	0	20K
Southern Il	11/11/1995	High Winds	0 kts.	0	0	0
Union	1/8/2006	Strong Wind	N/A	0	0	19K
Union	1/19/2006	Strong Wind	N/A	0	0	19K
Union	2/16/2006	Strong Wind	N/A	0	0	14K
Union	12/1/2006	Strong Wind	N/A	0	0	1K
Cobden	8/29/2007	Thunderstorm Wind	N/A	0	0	6K
Reynoldsville	10/18/2007	Thunderstorm Wind	N/A	0	0	50K
Ware	1/29/2008	Thunderstorm Wind	N/A	0	0	100K
Cobden To Anna	4/15/1994	Thunderstorm Winds	N/A	0	0	0
Reynoldsville	5/17/1995	Thunderstorm Winds	N/A	0	0	0
Jonesboro	5/18/1995	Thunderstorm Winds	N/A	0	0	0
Anna	5/18/1995	Thunderstorm Winds	N/A	0	0	0
Union	6/8/1995	Thunderstorm Winds	N/A	0	0	50K
Jonesboro	11/11/1995	Thunderstorm Winds	N/A	0	0	40K
Union	2/9/1960	Thunderstorm Winds	65 kts.	0	0	0
Union	3/16/1963	Thunderstorm Winds	0 kts.	0	0	0
Union	7/15/1966	Thunderstorm Winds	0 kts.	0	0	0
Union	8/9/1969	Thunderstorm Winds	61 kts.	0	0	0
Union	9/28/1974	Thunderstorm Winds	0 kts.	0	0	0
Union	5/30/1976	Thunderstorm Winds	0 kts.	0	0	0
Union	5/30/1976	Thunderstorm Winds	0 kts.	0	0	0
Union	5/12/1978	Thunderstorm Winds	0 kts.	0	0	0
Union	9/22/1980	Thunderstorm Winds	0 kts.	0	0	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Union	7/20/1981	Thunderstorm Winds	0 kts.	0	0	0
Union	8/24/1982	Thunderstorm Winds	0 kts.	0	0	0
Union	8/31/1982	Thunderstorm Winds	0 kts.	0	0	0
Union	12/25/1982	Thunderstorm Winds	0 kts.	0	0	0
Union	12/25/1982	Thunderstorm Winds	0 kts.	0	0	0
Union	7/5/1987	Thunderstorm Winds	0 kts.	1	0	0
Union	7/25/1988	Thunderstorm Winds	0 kts.	0	0	0
Union	8/27/1988	Thunderstorm Winds	0 kts.	0	0	0
Union	9/7/1990	Thunderstorm Winds	0 kts.	0	0	0
Anna	1/18/1996	Thunderstorm Winds	0 kts.	0	0	5K
Anna	5/5/1996	Thunderstorm Winds	0 kts.	0	2	50K
Anna	4/20/1997	Thunderstorm Winds	0 kts.	0	0	5K
Anna	7/14/1997	Thunderstorm Winds	50 kts.	0	0	4K
Dongola	5/21/1998	Thunderstorm Winds	50 kts.	0	0	5K
Ware	6/14/1998	Thunderstorm Winds	52 kts.	0	0	3K
Anna	6/29/1998	Thunderstorm Winds	55 kts.	0	0	30K
Anna	1/22/1999	Thunderstorm Winds	0 kts.	0	0	20K
Union	5/17/1999	Thunderstorm Winds	0 kts.	0	0	250K
Union	2/24/2001	Thunderstorm Winds	0 kts.	0	0	8K
Union	10/24/2001	Thunderstorm Winds	52 kts.	0	0	20K
Cobden	4/21/2002	Thunderstorm Winds	50 kts.	0	0	0
Anna	7/10/2002	Thunderstorm Winds	50 kts.	0	0	3K
Saratoga	11/9/2002	Thunderstorm Winds	52 kts.	0	0	5K
Union	5/6/2003	Thunderstorm Winds	50 kts.	0	0	0
Alto Pass	7/18/2003	Thunderstorm Winds	50 kts.	0	0	0
Jonesboro	7/18/2003	Thunderstorm Winds	50 kts.	0	0	0
Ware	8/4/2003	Thunderstorm Winds	50 kts.	0	0	0
Jonesboro	5/30/2004	Thunderstorm Winds	50 kts.	0	0	0
Alto Pass	6/12/2004	Thunderstorm Winds	50 kts.	0	0	0
Dongola	6/18/2004	Thunderstorm Winds	50 kts.	0	0	0
Dongola	6/18/2004	Thunderstorm Winds	50 kts.	0	0	0
Anna	11/6/2005	Thunderstorm Winds	50 kts.	0	0	0
Cobden	11/15/2005	Thunderstorm Winds	56 kts.	0	0	10K
Anna	3/9/2006	Thunderstorm Winds	57 kts.	0	0	40K

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Cobden	4/30/2006	Thunderstorm Winds	61 kts.	0	0	50K
Ware	5/25/2006	Thunderstorm Winds	50 kts.	0	0	0
Anna	7/14/2006	Thunderstorm Winds	50 kts.	0	0	0
Jonesboro	8/10/2006	Thunderstorm Winds	50 kts.	0	0	3K
Union	4/20/2000	Wind	N/A	0	0	0
Union	3/9/2002	Wind	N/A	0	0	3K

Source: NCDC

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Thunderstorm Hazard

The entire county has the same risk for occurrence of thunderstorms. They can occur at any location within the county.

Hazard Extent for Thunderstorm Hazard

The extent of the historical thunderstorms listed previously varies in terms of the extent of the storm, the wind speed, and the size of hailstones. Thunderstorms can occur at any location within the county.

Calculated Risk Priority Index for Thunderstorm Hazard

Based on historical information, the probability of future high wind damage is highly likely. High winds with widely varying magnitudes are expected to happen. According to the RPI, thunderstorms and high wind damage ranked as the number six hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
4	x	2	=	8

Vulnerability Analysis for Thunderstorm Hazard

Severe thunderstorms are an evenly distributed threat across the entire jurisdiction; therefore, the entire county's population and all buildings are susceptible to severe thunderstorms and can expect the same impacts. This plan will therefore consider all buildings located within the county as vulnerable. The existing buildings and infrastructure in Union County are discussed in types and numbers in Table 4-10.

Critical Facilities

All critical facilities are vulnerable to severe thunderstorms. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of function of the facility (e.g. a damaged police station will no longer be able to serve the community). Table 4-8 lists the types and numbers of all essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is provided in Table 4-9. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g. a damaged home will no longer be habitable causing residence to seek shelter).

Infrastructure

During a severe thunderstorm, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a severe thunderstorm. The impacts to these items include broken, failed or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

Vulnerability to Future Assets/Infrastructure for Thunderstorm Hazard

All future development within the county and all communities will remain vulnerable to these events.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warning of approaching storms are also vital to preventing the loss of property and ensuring the safety of Union County residents.

4.4.5 Winter Storm Hazard

Hazard Definition for Winter Storm Hazard

Severe winter weather consists of various forms of precipitation and strong weather conditions. This may include one or more of the following conditions: freezing rain, sleet, heavy snow, blizzards, icy roadways, extreme low temperatures, and strong winds. These conditions can cause human health risks such as frostbite, hypothermia, and death.

Ice (glazing) and Sleet Storms

Ice or sleet, even in small quantities, can result in hazardous driving conditions and can cause property damage. Sleet involves frozen raindrops that bounce when they hit the ground or other objects. Sleet does not stick to trees and wires. Ice storms, on the other hand, involve liquid rain that falls through subfreezing air and/or onto sub-freezing surfaces, freezing on contact with those surfaces. The ice coats trees, buildings, overhead wires, and roadways, sometimes causing extensive damage.

The most damaging winter storms in southern Illinois have been ice storms. Ice storms occur when moisture-laden gulf air converges with the northern jet stream causing strong winds and heavy precipitation. This precipitation takes the form of freezing rain coating power and communication lines and trees with heavy ice. The winds will then cause the overburdened limbs and cables to snap; leaving large sectors of the population without power, heat, or communication. In the past few decades, including the winter of 2007–09, numerous ice storm events have occurred in southern Illinois.

Snow Storms

Significant snow storms are characterized by the rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility. A blizzard is categorized as a snow storm with winds of 35 miles per hour or greater and/or visibility of less than ¼ mile for three or more hours. Blizzards are the most dramatic and perilous of all winter storm events. Most snow within a blizzard is in the form of fine, powdery particles, which are wind-blown in such great quantities that visibility is reduced to only a few feet. Blizzards have the potential to result in property damage.

Illinois has repeatedly been struck by blizzards, although they are less common in the southern part of the state. Blizzard conditions can cause power outages, loss of communication, and make transportation impossible. The blowing of snow can reduce visibility to less than ¼ mile, resulting in disorientation that can make even travel by foot dangerous.

Severe Cold

Severe cold is characterized by the ambient air temperature that may drop to 0°F or below. These extreme temperatures can increase the likelihood of frostbite and hyperthermia. High winds during severe cold events can enhance the air temperature's effects. Fast winds during cold

weather events can lower the Wind Chill Factor (how cold the air feels on your skin), which can lower the time it takes for frostbite and hypothermia to affect a person's body.

Previous Occurrences for Winter Storm Hazard

The NCDC database identified 53 winter storm and extreme cold events for Union County since 1994. These storms have been attributed with three deaths, one injury, and \$1.75 million in property damage in Union and surrounding counties. A recent example a severe winter storm occurred in February 2008, low pressure developed over the southern Plains, spreading widespread heavy precipitation across southern Illinois. At the same time, high pressure over the upper Ohio Valley produced a cold easterly wind flow. The result was a crippling ice storm.

Approximately one inch of ice caused extensive damage across far southern Illinois, along and south of a line from Carbondale and Marion to Harrisburg and Carmi. Many of those same areas received three to six inches of sleet and snow. The most destructive icing occurred in an east to west band across Alexander, Johnson, Union, and Pope Counties. The state designated most counties in southern Illinois as a disaster area. Numerous trees and power lines were brought down, knocking out power to many thousands of homes. Power outages lasted up to a week.

The NCDC winter storms for Union County are listed in Table 4-35. Additional details for NCDC events are included in Appendix D.

Table 4-35: Winter Storm Events*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Southern Illinois	3/8/1994	Heavy Snow	N/A	0	0	500K
Union	9/24/1995	Frost	N/A	0	0	0
Southern Il	12/8/1995	Snow	N/A	0	0	0
Southern Il	12/9/1995	Cold Wave	N/A	0	0	0
Union	1/2/1996	Winter Storm	N/A	0	0	0
Union	1/6/1996	Winter Storm	N/A	0	0	0
Union	2/2/1996	Extreme Cold	N/A	0	0	0
Union	2/5/1996	Ice Jam	N/A	0	0	0
Union	12/16/1996	Winter Storm	N/A	0	0	0
Union	1/8/1997	Winter Storm	N/A	0	0	0
Union	1/10/1997	Extreme Windchill	N/A	1	0	0
Union	1/15/1997	Ice Storm	N/A	0	0	0
Union	4/18/1997	Frost	N/A	0	0	0
Union	1/17/1998	Freezing Drizzle	N/A	0	0	0
Anna	6/14/1998	Funnel Cloud	N/A	0	0	0
Union	12/21/1998	Freezing Rain	N/A	0	0	0
Union	12/23/1998	Snow	N/A	0	0	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Union	1/1/1999	Ice Storm	N/A	0	0	150K
Union	1/8/1999	Ice Storm	N/A	0	0	0
Union	3/14/1999	Heavy Snow	N/A	0	0	0
Union	1/22/2000	Snow	N/A	0	0	0
Union	4/9/2000	Frost	N/A	0	0	0
Union	10/9/2000	Frost	N/A	0	0	0
Union	12/12/2000	Extreme Cold	N/A	0	0	0
Union	12/13/2000	Winter Storm	N/A	0	0	0
Union	12/15/2000	Freezing Rain	N/A	0	0	0
Union	1/1/2001	Extreme Cold	N/A	0	0	0
Union	1/26/2001	Freezing Rain	N/A	0	0	0
Union	2/21/2001	Winter Storm	N/A	0	0	0
Union	4/18/2001	Frost	N/A	0	0	0
Union	1/19/2002	Heavy Snow	N/A	0	0	0
Union	12/4/2002	Winter Storm	N/A	0	0	0
Union	12/23/2002	Winter Storm	N/A	0	0	0
Union	1/16/2003	Winter Storm	N/A	0	0	0
Union	1/22/2003	Winter Weather/mix	N/A	0	0	0
Union	1/23/2003	Extreme Cold/wind Chill	N/A	0	0	0
Union	2/6/2003	Heavy Snow	N/A	0	0	0
Union	2/16/2003	Winter Storm	N/A	0	0	0
Union	2/23/2003	Heavy Snow	N/A	0	0	0
Union	10/3/2003	Frost/freeze	N/A	0	0	0
Union	1/25/2004	Ice Storm	N/A	0	0	0
Union	2/5/2004	Heavy Snow	N/A	0	0	0
Union	12/22/2004	Winter Storm	N/A	1	1	100K
Union	12/23/2004	Extreme Cold/wind Chill	N/A	1	0	0
Union	5/4/2005	Frost/freeze	N/A	0	0	0
Union	10/28/2005	Frost/freeze	N/A	0	0	0
Union	12/8/2005	Winter mix	N/A	0	0	0
Union	2/18/2006	Winter mix	N/A	0	0	0
Union	2/19/2006	Winter mix	N/A	0	0	0
Union	2/3/2007	Winter Weather	N/A	0	0	0K
Union	12/15/2007	Winter Weather	N/A	0	0	0K

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Ware	2/5/2008	Funnel Cloud	N/A	0	0	OK
Union	2/11/2008	Winter Storm	N/A	0	0	1.0M

Source: NCDC

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Winter Storm Hazard

Severe winter storms are regional in nature. Most of the NCDC data is calculated regionally or in some cases statewide.

Hazard Extent for Winter Storm Hazard

The extent of the historical winter storms listed previously varies in terms of storm extent, temperature, and ice or snowfall. Severe winter storms affect the entire jurisdiction equally.

Calculated Risk Priority Index for Winter Storm Hazard

Based on historical information, the probability of future winter storms is likely. Winter storms of varying magnitudes are expected to happen. According to the RPI, winter storms were ranked as the number sixth.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
3	x	2	=	6

Vulnerability Analysis for Winter Storm Hazard

Winter storm impacts are evenly distributed across the jurisdiction; therefore the entire county is vulnerable to winter storms and can expect the same impacts within the affected area. The building exposure for Union County, as determined from the building inventory, is included in Table 4-10.

Critical Facilities

All critical facilities are vulnerable to a winter storm. A critical facility will encounter many of the same impacts as any other buildings within the jurisdiction. These impacts include loss of gas or electricity from broken or damaged utility lines, roads and railways damaged or impassable, broken water pipes, and roof collapse from heavy snow. Table 4-8 lists the types and numbers of

the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

Table 4-9 lists the building exposure in terms of types and numbers of buildings for the entire county. The impacts to the building stock within the county are similar to the damages expected to the critical facilities, including loss of gas or electricity from broken or damaged utility lines, roads and railways damaged or impassable, broken water pipes, and roof collapse from heavy snow.

Infrastructure

During a winter storm, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a winter storm. Potential impacts include broken gas and/or electricity lines, or damaged utility lines, damaged or impassable roads and railways, and broken water pipes.

Vulnerability to Future Assets/Infrastructure for Winter Storm Hazard

Any new development within the county will remain vulnerable to these events.

Analysis of Community Development Trends

Because the winter storm events are regional in nature, future development will be impacted across the county. Rural areas in Union County are particularly vulnerable due to the likely hood of long term power outages. Human service agencies, volunteer organizations, the Union County Health Department, medical and health care facilities, and schools have definite roles to play in public education, planning, and response to extreme winter conditions.

4.4.7 Hazardous Materials Storage and Transport Hazard

Hazard Definition for Hazardous Materials Storage and Transport Hazard

Explosions result from the ignition of volatile materials such as petroleum products, natural gas and other flammable gases, hazardous materials/chemicals and dust, and explosive devices. An explosion can potentially cause death, injury, and property damage. In addition, a fire routinely follows an explosion, which may cause further damage and inhibit emergency response. Emergency response may require fire, safety/law enforcement, search and rescue, and hazardous materials units.

Previous Occurrences for Hazardous Materials Storage and Transport Hazard

Union County has not experienced a significant or large-scale hazardous material incident at a fixed site or transportation route that has resulted in multiple deaths or serious injuries.

Geographic Location for Hazardous Materials Storage and Transport Hazard

The hazardous material hazards are countywide and are primarily associated with the transport of materials via highway or rail.

Hazard Extent for Hazardous Materials Storage and Transport Hazard

The extent of the hazardous material hazard varies both in terms of the quantity of material being transported as well as the specific content of the container.

Calculated Risk Priority Index for Hazardous Materials Storage and Transport Hazard

The possibility of a hazardous materials accident is likely, based on input from the planning team. According to the RPI, Hazardous Materials Storage and Transport ranked as the number five hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
2	x	4	=	8

Vulnerability Analysis for Hazardous Materials Storage and Transport Hazard

Hazardous material impacts are evenly distributed across the jurisdiction; therefore the entire county is vulnerable to a release associated with hazardous materials storage or transport and can expect the same impacts within the affected area. The building exposure for Union County, as determined from building inventory, is included in Table 4-9. This plan will therefore consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities and communities within the county are at risk. A critical facility, if vulnerable, will encounter many of the same impacts as other buildings within the jurisdiction. These impacts include structural failure due to fire or explosion and loss of function of the facility (e.g. a damaged police station will no longer be able to serve the community). Table 4-9 lists the types and numbers of all essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

Table 4-9 lists the building exposure in terms of type and number of buildings for the entire county. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure due to fire or explosion or debris and loss of function of the building (e.g. a damaged home will no longer be habitable causing residence to seek shelter).

Infrastructure

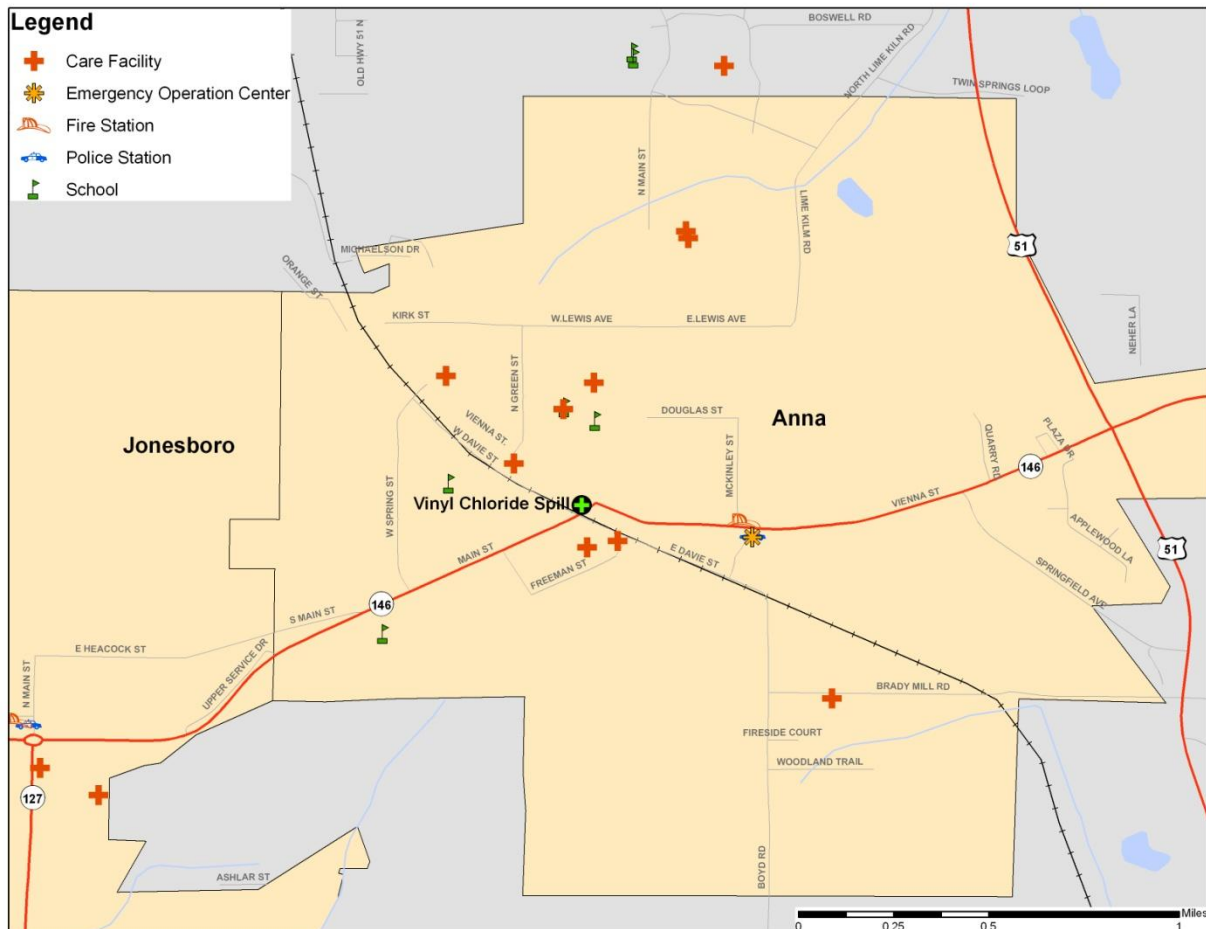
During a hazardous materials release, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since a full inventory of infrastructure is not available for this plan, it is important to emphasize that any number of these items could become damaged in the event of a hazardous material release. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

The U.S. EPA's ALOHA (Areal Locations of Hazardous Atmospheres) is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. ALOHA was utilized to assess the area of impact for a vinyl chloride release at the rail crossing of State Route 146 (Main St.) in Anna. Rail tankers commonly transport vinyl chloride and other hazardous materials through the City of Anna.

Vinyl chloride is a colorless gas with a sweet odor used to make plastics, adhesives, and other chemicals. Because it is easily ignited, it is shipped as a liquefied gas under its own vapor pressure. Leaks may be liquid or vapor—vapor is heavier than liquid: skin contact with the unconfined liquid may cause frostbite by evaporative cooling, and the displacement of air may cause asphyxiation. Under prolonged exposure to fire or intense heat, the containers may rupture violently and rocket. Vinyl chloride is a suspected carcinogen (NOAA Reactivity 2007).

Source: <http://cameochemicals.noaa.gov/chemical/1692>

For this scenario, moderate atmospheric and climatic conditions with a slight breeze from the south were assumed. The target area was selected for three primary reasons: 1) the high volume of train and vehicle traffic, 2) the area is highly populated, and 3) proximity to several critical facilities. The geographic area covered in this analysis is depicted in Figure 4-13.

Figure 4-13: Location of Chemical Release

Analysis

The ALOHA atmospheric modeling parameters, depicted in Figure 4-14, were based upon a north-northwesterly wind speed of five miles per hour. The temperature was 68°F with 75% humidity and partly cloudy skies.

The source of the chemical spill is a horizontal, cylindrical-shaped tank. The diameter of the tank was set to 8 feet and the length set to 33 feet with 12,408 gallons of fluorine. At the time of its release, it was estimated that the tank was 100% full. The vinyl chloride in this tank is in its gas state.

This release was based on a leak from a 2.5 inch-diameter hole, at the bottom of the tank.

Figure 4-14: ALOHA Plume Modeling Parameters**SITE DATA:**

Location: ANNA, ILLINOIS
Building Air Exchanges Per Hour: 0.29 (sheltered single storied)
Time: April 30, 2009 0910 hours CDT (user specified)

CHEMICAL DATA:

Chemical Name: VINYL CHLORIDE Molecular Weight: 62.50 g/mol
TEEL-1: 50 ppm TEEL-2: 5000 ppm TEEL-3: 20000 ppm
LEL: 36000 ppm UEL: 330000 ppm
Ambient Boiling Point: 5.7° F
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)

Wind: 5 miles/hour from W at 10 meters
Ground Roughness: open country Cloud Cover: 5 tenths
Air Temperature: 68° F Stability Class: C
No Inversion Height Relative Humidity: 75%

SOURCE STRENGTH:

Leak from hole in horizontal cylindrical tank
Flammable chemical escaping from tank (not burning)
Tank Diameter: 8 feet Tank Length: 33 feet
Tank Volume: 12,408 gallons
Tank contains liquid Internal Temperature: 68° F
Chemical Mass in Tank: 47.2 tons Tank is 100% full
Circular Opening Diameter: 2.5 inches
Opening is 12 inches from tank bottom
Release Duration: 30 minutes
Max Average Sustained Release Rate: 5,490 pounds/min
(averaged over a minute or more)
Total Amount Released: 93,771 pounds
Note: The chemical escaped as a mixture of gas and aerosol (two phase Flow).

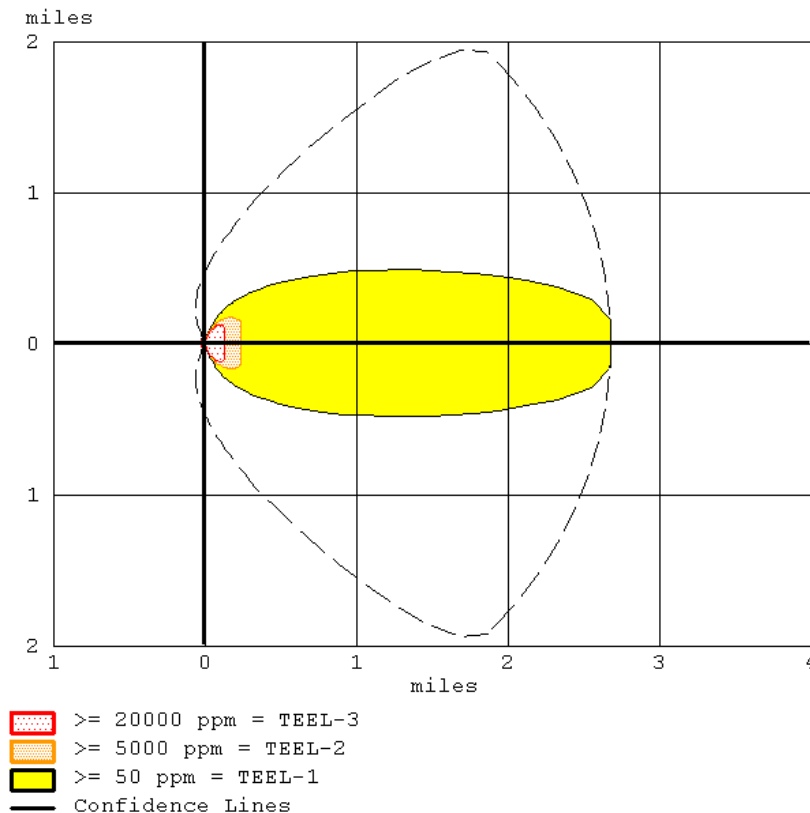
TEELs (Temporary Emergency Exposure Limits) are derived using existing LOCs (Levels of Concerns) and by manipulating current data. This process is less intensive than the AEGL or ERPG process, and TEELs have been defined for more than 3,000 chemicals.

- TEELs are used to help protect the public when AEGLs or ERPGs are not available and there has been a chemical release that is short-term in duration.
- TEELs estimate how the majority of people (except for sensitive individuals) would react to a release of this nature; TEELs could then be used to identify areas where a release of the toxic gas concentration would qualify as hazardous. For example, in areas with concentrations above the TEEL-1, most people would detect the chemical and may experience temporary, mild effects. On the other hand, in areas with concentrations above the TEEL-2, most people would experience significant, though not life-threatening, health effects.

- TEELs are derived by the U.S. Department of Energy Subcommittee on Consequence Assessment and Protective Actions (SCAPA) according to a specific, standard methodology. The TEEL methodology determines the TEELs by using available levels of concern and manipulating current data using a peer-reviewed, approved procedure.
- TEELs can be derived relatively quickly for almost any chemical, and as a result, are available for thousands of chemicals. TEELs can provide a useful reference when no other public exposure guidelines are available.

According to the ALOHA parameters, approximately 5,490 pounds per minute of material would be released per minute. The image in Figure 4-15 depicts the plume footprint generated by ALOHA.

Figure 4-15: Plume Footprint Generated by ALOHA

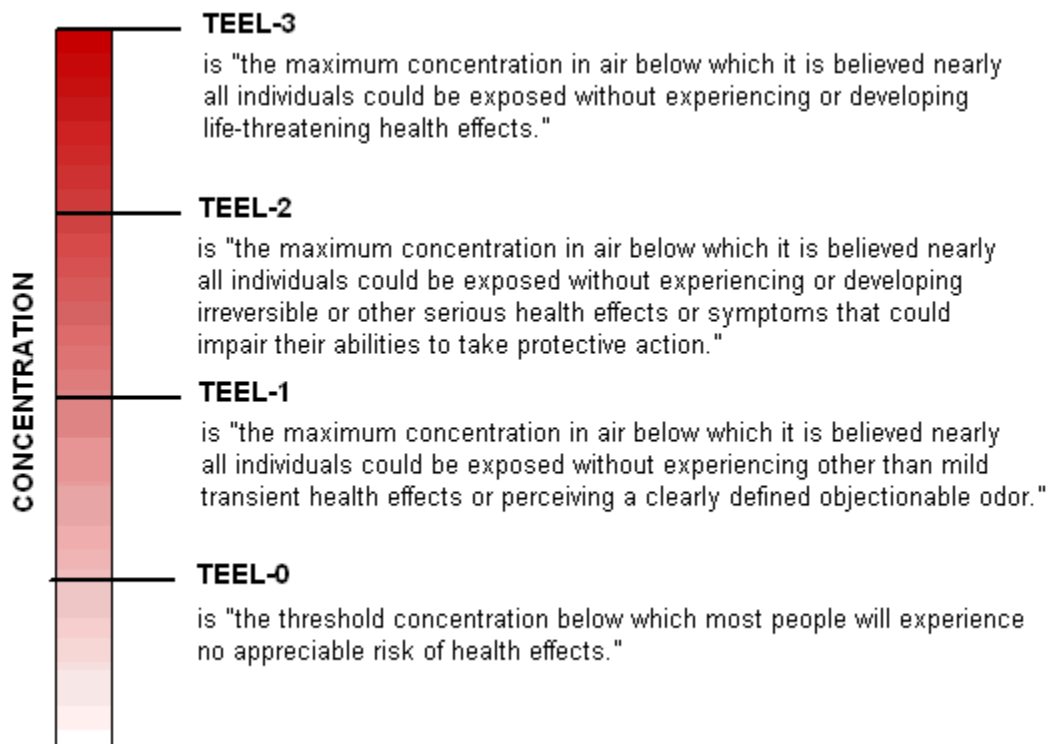


As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million (ppm). For the purpose of clarification, this report will designate each level of concentration as a specific zone. The zones are as follows:

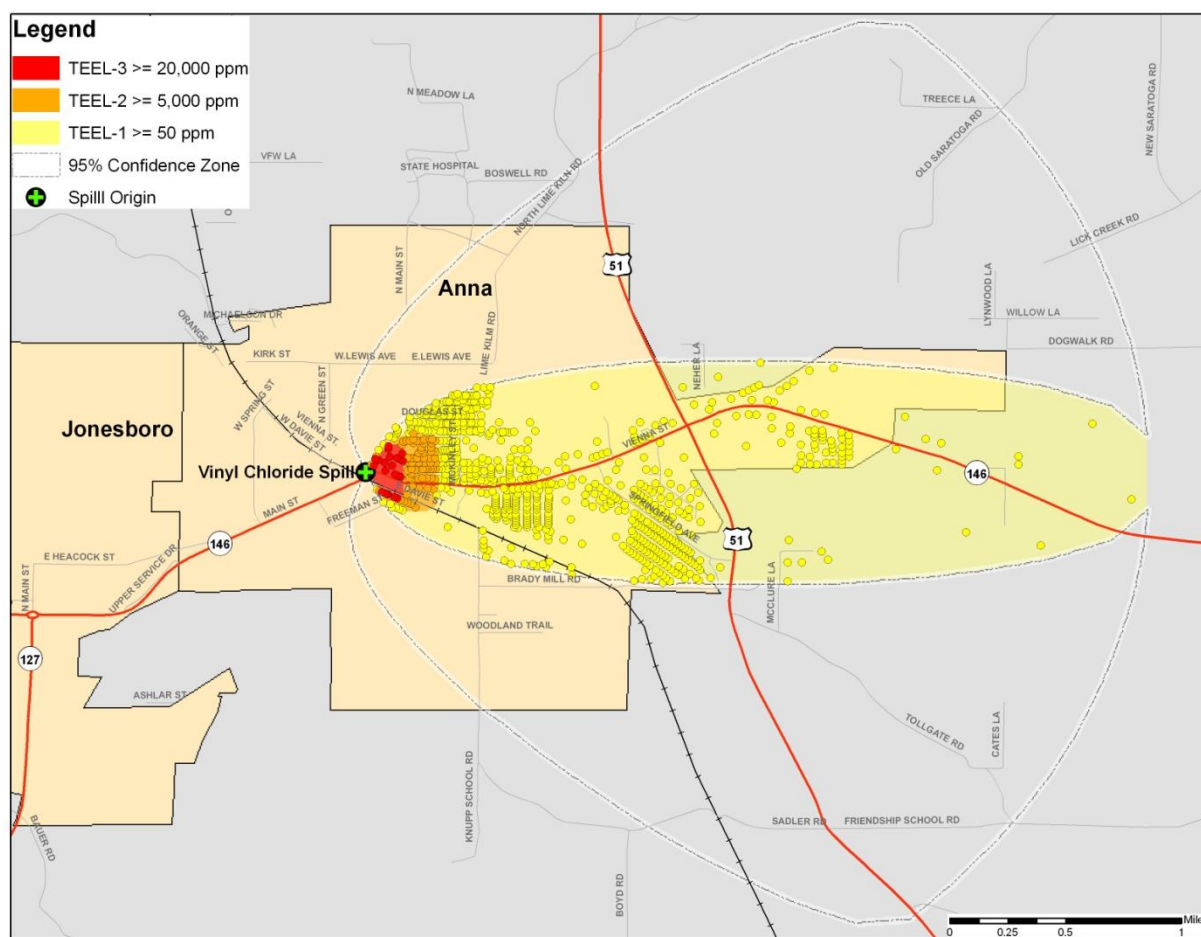
- **Zone 1 (TEEL-3):** The red buffer ($\geq 20,000$ ppm) extends no more than 0.2 miles from the point of release after one hour.
- **Zone 2 (TEEL-2):** The orange buffer (≥ 5000 ppm) extends no more than 0.5 miles from the point of release after one hour.
- **Zone 3 (TEEL-1):** The yellow buffer (≥ 50 ppm) extends more than 2.5 miles from the point of release after one hour.
- **Zone 4 (Confidence Lines):** The dashed lines depict the level of confidence in which the exposure zones will be contained. The ALOHA model is 95% confident that the release will stay within this boundary.

TEELs estimate the concentrations at which most people will begin to experience health effects if they are exposed to a toxic chemical for a given duration. (Sensitive members of the public, such as old, sick, or very young people, are not covered by these guidelines; they may experience adverse effects at concentrations below the TEEL values.) TEELs are used in similar situations as the 60-minute AEGLs and ERPGs. Each TEEL includes four tiers, defined in Figure 4-16.

Figure 4-16: TEEL Concentration Tiers



TEEL-0 tier is essentially a no-effects threshold. It is often ignored for emergency response and planning purposes. ALOHA treats TEELs as a three-tiered guideline (TEEL-1, TEEL-2, and TEEL-3), which can be compared in a general way to the AEGL and ERPG tiers. ALOHA does not include TEEL-0 values.

Figure 4-18: Union County Building Inventory Classified By Plume Footprint

Results

By summing the building inventory within all TEELs zones (Zone 1: $\geq 20,000$ ppm, Zone 2: $\geq 5,000$ ppm, and Zone 3: ≥ 5.0 ppm), the GIS overlay analysis predicts that as many as 745 buildings could be exposed which have a replacement cost of approximately \$51.3 million dollars. In addition approximately 1,860 people could be affected.

Building Inventory Damage

The results of the analysis against known structure locations are depicted in Table 4-36. Table 4-37 includes the results of the analysis against the Union County Assessor Data.

Table 4-36: Number of Buildings Exposed

Occupancy	Zone 1	Zone 2	Zone 3
Residential	8	51	551
Commercial	14	19	90
Industrial	0	0	3
Agricultural	0	0	7
Exempt*	0	0	0
Government*	0	0	2
Education*	0	0	0
Total	22	70	653

Table 4-37: Estimated Building Exposure Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3
Residential	\$7,921,980	\$870,120	\$16,475,625
Commercial	\$2,245,500	\$1,325,640	\$18,400,980
Industrial	0	0	\$1,357,450
Agriculture	0	0	\$446,880
Exempt*	0	0	0
Government*	0	0	\$2,220,000
Education*	0	0	0
Total	\$10,167,480	\$2,195,760	\$38,900,935

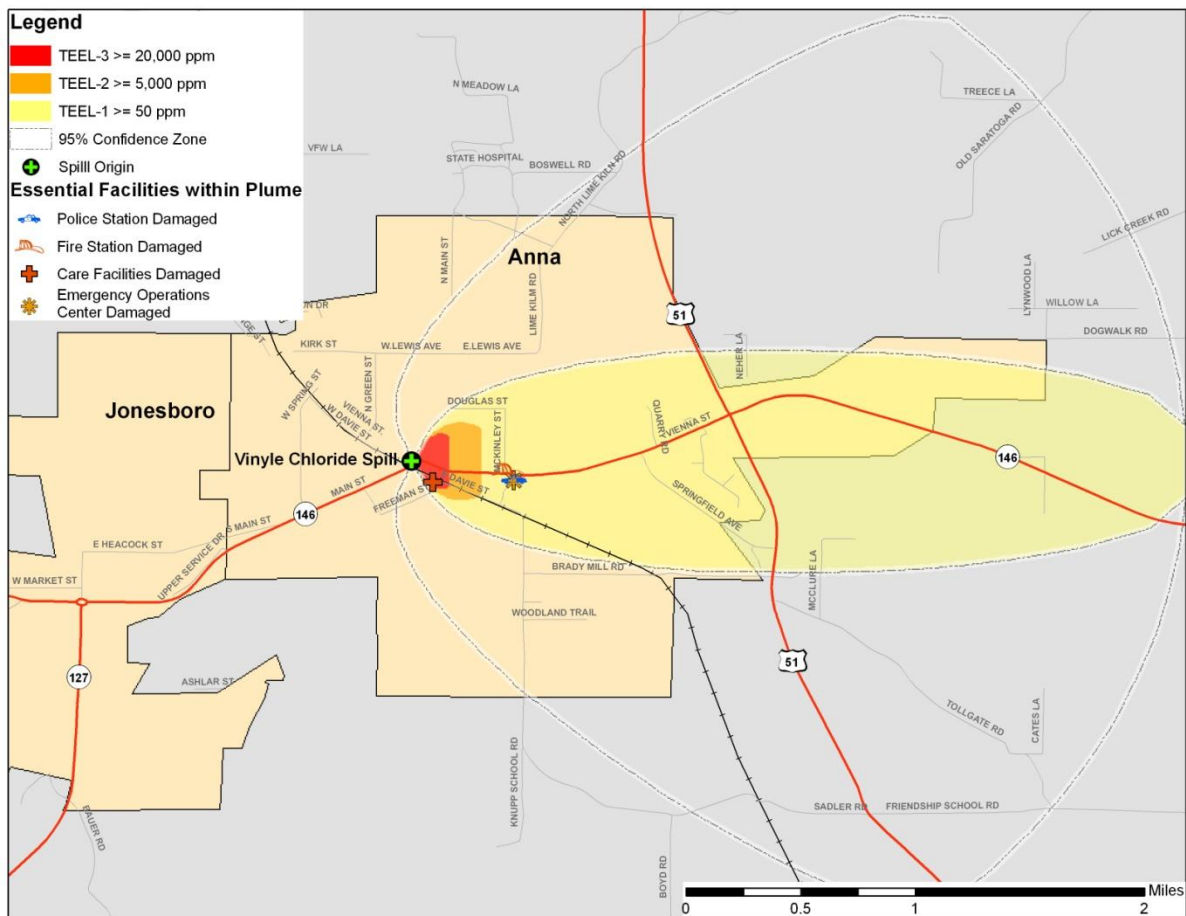
* Assessor records often do not distinguish parcels by occupancy class when the parcels are not taxable; therefore, the total number of building and building replacement costs for government, exempt, and non-profit may be underestimated.

Essential Facilities Damage

There are 11 essential facilities within the limits of the chemical spill plume. The affected facilities are identified in Table 4-38. Their geographic locations are depicted in Figure 4-19.

Table 4-38: Essential Facilities within Plume Footprint or 95% Confidence Interval

Name
City Care Center
Holly Hill Nursing Home
Mulberry Manor
Rural Health
Union County Hospital
Illinois Veterans Home at Anna
The Fellowship House
Anna Fire Department
Anna Police Department
Lincoln Elementary School
Anna Pre-K

Figure 4-19: Essential Facilities within Plume Footprint

Vulnerability to Future Assets/Infrastructure for Hazardous Materials Storage and Transport Hazard

A significant portion of the Unions County's population lives in close proximity to transportation corridors, such as the Canadian National Rail Road Line, the Union Pacific Rail Line, Interstate 57, U.S. Route 51, Illinois State Route 3, 127, and 146. These areas are particularly vulnerable to chemical releases because of transportation of hazardous materials.

Analysis of Community Development Trends

Because of the concentration of Union County's Population to the transportation network, future development is likely to be vulnerable. The major transportation routes in Alexander County pose a threat of dangerous chemicals and hazardous materials release Alexander County will continue to provide a comprehensive means to mitigate, prepare for, respond to, and recover from hazards relating to hazardous materials releases.

4.4.8 Fire\Explosion

Hazard Definition for Fire\Explosion Hazard

The Union County has identified three major categories of fires within the county. These include structure fires, wildland fires, and other fires. A structure fire is any fire involving an assembly of materials for occupancy or use to serve a specific purpose. This includes buildings, open platforms, bridges, or roof assemblies over open storage or process areas. A wildland fire is any fire involving vegetative fuels that occurs in the wildland or urban-wildland interface areas. The other category captures all other fires not covered by wildland or structure fire. Examples of such fires included vehicle fires, trash or rubbish fires, and outside gas or vapor combustion.

Previous Occurrences of Fire\Explosion

Record of all fires in Union County between January 1, 2007 and February 8, 2009 were obtained from the Illinois State Fire Marshal. In addition to these data, wildland fire data were obtained for the Shawnee National Forest and adjacent areas from the U.S. Forest Service for the period January 1986 through December 2008.

Union County has not experienced a significant or large-scale explosion at a fixed site or transportation route that has resulted in multiple deaths or serious injuries.

Structural Fires

In terms of average annual loss property, structural fires are by far one of the most significant hazards facing Union County. Between January 2007 and February 2009 structure fires were attributed with one injury and over 1.7 million dollars in property damage. Table 4-39 presents the number of fires, causes, estimated losses and casualties attributed to these fires by jurisdiction.

Wildland Fires

Forested areas cover approximately half of Union County's total land base (Figure 3-2). When conditions are right, forests may become vulnerable to wildfires. Between January 2007 and February 2009 14 wildland fires occurred in Union County outside the Shawnee National Forest (Table 4-39). Between 1986 and 2008, U.S. Forest Service Records revealed the occurrence of 66 wildland fires within and near the Shawnee Nation Forest within Union County. These fires range in size from less than 1 up to 245 acres. However, most (70%) of these fires are less than 10 acres in size. These fires generally occur near roads, railroad, campgrounds, and the urban wildland interface. Figure 4-20 shows the location of the Shawnee Nation Forest in Southern Illinois and the wildland fire density within and near the Forest.

Other Fires

Other Fires in Union County include vehicle fires, dumpster fires, and the burning of rubbish (e.g., house hold trash, construction debris, tires, or old railroad ties). Between January 2007 and February 2009, 33 such fires occurred resulting in one death and \$367,000 in property damage.

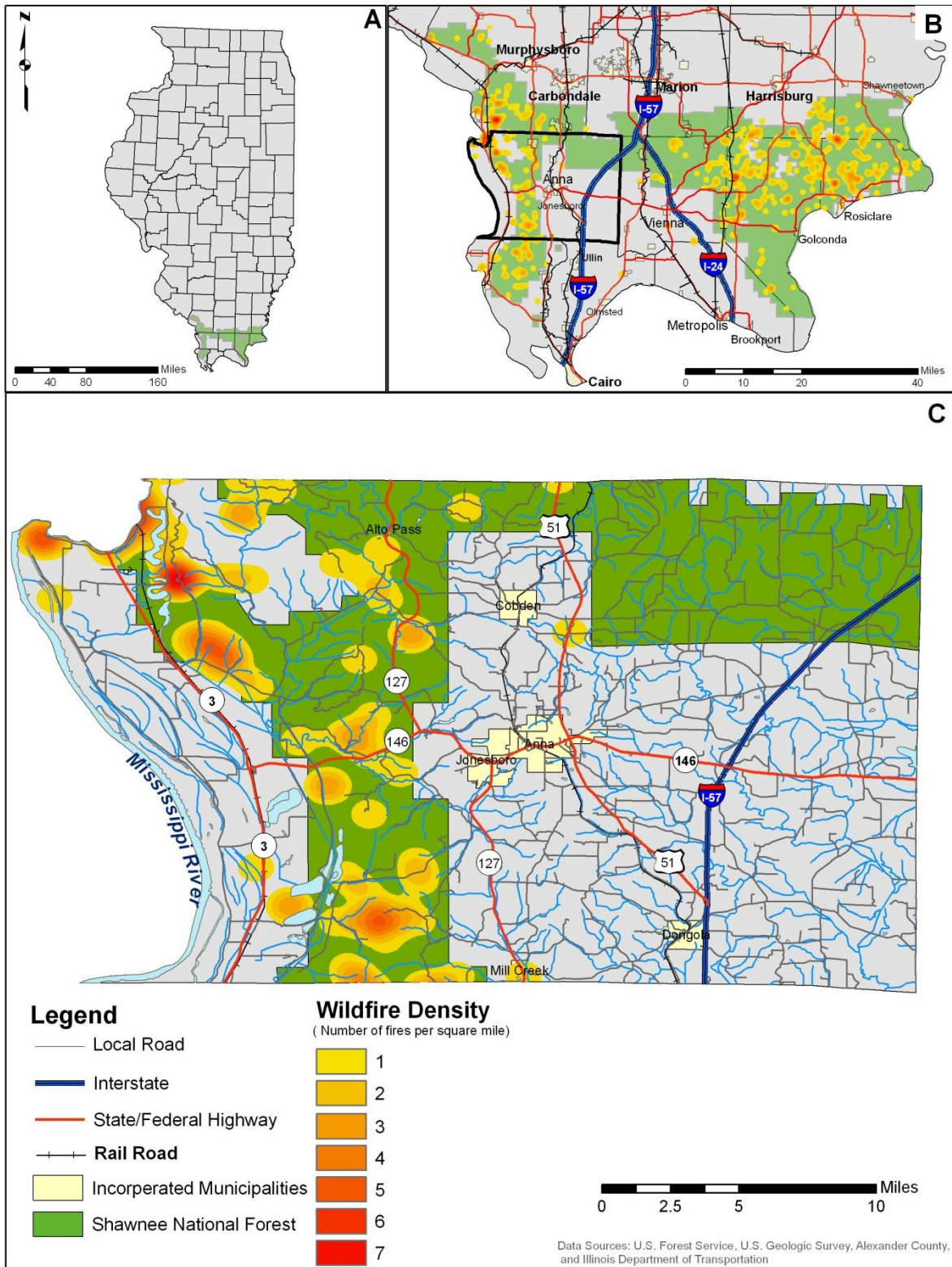
Most of the property damage was to vehicles and their contents. Table 4-39 presents the number of fires, causes, and estimated losses attributed to these fires by jurisdiction, and Figure 4-20 shows density of wildland fires within the Shawnee National Forest.

Table 4-39 Union County Fires 2007 to 2009

Structure Fires										
Jurisdiction	Cause					Total	Estimated Losses		Injuries	Deaths
	Accidental	Intentional	Natural	Undetermined	Under Investigation		Property	Total		
Union County	3	0	0	0	0	3	\$76,000	\$78,000	0	0
Alto Pass	1	0	0	0	0	1	\$0	\$0	0	0
Anna	12	0	0	0	0	12	\$261,099	\$396,099	0	0
Cobden	17	1	0	0	0	18	\$1,069,200	\$1,495,500	1	0
Dongola	9	0	0	0	0	9	\$275,000	\$376,500	0	0
Jonesboro	9	0	1	0	0	10	\$28,800	\$58,450	0	0
Total	51	1	1	0	0	53	\$1,710,099	\$2,404,549	1	0

Wildland Fires										
Jurisdiction	Cause					Total	Estimated Losses		Injuries	Deaths
	Accidental	Intentional	Natural	Undetermined	Under Investigation		Property	Total		
Union County	10	3	0	0	0	13	\$0	\$0	0	0
Alto Pass	4	0	0	0	0	4	\$0	\$0	0	0
Anna	2	0	0	0	0	2	\$0	\$0	0	0
Cobden	3	0	1	0	0	4	\$0	\$0	0	0
Dongola	0	0	0	0	0	0	\$0	\$0	0	0
Jonesboro	2	0	0	0	0	2	\$0	\$0	0	0
Total	13	0	1	0	0	25	\$0	\$0	0	0

Other Fires										
Jurisdiction	Cause					Total	Estimated Losses		Injuries	Deaths
	Accidental	Intentional	Natural	Undetermined	Under Investigation		Property	Total		
Union County	4	0	0	0	0	4	\$76,000	\$78,000	0	0
Alto Pass	0	0	0	0	0	0	\$0	\$0	0	0
Anna	1	0	0	0	0	1	\$250	\$250	0	0
Cobden	8	0	1	0	0	9	\$28,700	\$28,700	0	0
Dongola	13	1	0	0	0	14	\$253,500	\$278,350	0	1
Jonesboro	5	0	0	0	0	5	\$8,500	\$9,000	0	0
Total	31	1	1	0	0	33	\$366,950	\$394,300	0	1

Figure 4-20 Shawnee National Forest Wildland Fire Density

Geographic Location for Fire Hazard

The structure and other fire hazards are countywide. Wildland Fires are limited to forested areas located in the north-central portion of the county.

Hazard Extent for Fire Hazard

The extent of the fire hazard varies both in terms of the extent of the fire and the type of material being ignited.

Calculated Priority Risk Index for Fire Hazard

Based on historical data and input from the Union County ESDA and U.S. National Forest Service large damaging structure fires, wildland fires and explosions are possible. However, the magnitude of the damage from such an event at the county level will likely be negligible. According to the CPRI, Hazardous fires are ranked as the number seven hazard in the county.

Probability	x	Magnitude /Severity	=	RPI
2	x	1	=	2

Vulnerability Analysis for Fire\Explosion Hazard

Fires and explosions are local phenomena. A large fire or explosion can possibly occur in Union County and the damage maybe locally severe. However, the extent of damage to county as a whole is likely to be negligible. Union County has a well-established network of fire departments with equipment capacities that enable an effective response. However for wildland fires, Union County fire services and private land owners near the National Forest should work with the U.S. Forest Service to reduce fuel loads and developed the necessary wildland urban interface buffers to limit potential property damage from such fires.

Analysis of Community Development Trends

Vulnerable of Union County to fires and explosions is countywide. Mitigation of the structure fire and explosions is depended on property and business owners to properly maintain their structures and machinery / equipment contained within. New development may occur within the wildland urban interface potentially increasing the risk of property damage due to wildland fire. Planned construction in these areas should be reviewed so proper protective measures are taken to minimize the wildland risk to these properties.

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Section 5 - Mitigation Strategy

The goal of mitigation is to reduce a hazard's future impacts including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. The goal of mitigation is to build disaster-resistant communities. Mitigation actions and projects should be based on a well-constructed risk assessment; Union County's is provided in Section 4 of this plan. Mitigation should be an ongoing process that adapts over time to accommodate the community's needs.

5.1 Community Capability Assessment

The capability assessment identifies current activities used to mitigate hazards. The capability assessment identifies the policies, regulations, procedures, programs, and projects that contribute to the lessening of disaster damages. The assessment also provides an evaluation of these capabilities to determine whether the activities can be improved in order to more effectively reduce the impact of future hazards. The following sections identify existing plans and mitigation capabilities within all of the communities listed in Section 2 of this plan.

5.1.1 National Flood Insurance Program (NFIP)

Union County is a member of the NFIP. The Village of Alto Pass and the Village of Cobden have no identified flood hazard boundaries; therefore, the communities do not participate in the NFIP. The City of Anna, the Village of Dongola and the City of Jonesboro do have identified flood boundaries but, have previously chosen not to participate in the program due to lack of interest or perceived need. The County will continue to educate these jurisdictions on the benefits of the program.

HAZUS-MH estimates that approximately 530 households were located in the Union County Special Flood Hazard Area; as of June 18, 2007, the Federal Emergency Management Agency NFIP Insurance Report for Illinois stated that 104 households paid flood insurance, insuring \$7,284,300 in property value. The total premiums collect amounted to \$65,535 which on average was \$630 annually. From 1978 to 2007, 77 claims were filed, totaling \$83,858. The average claim was \$1,089.

The county and incorporated areas do not participate in the National Flood Insurance Program's (NFIP) Community Rating System (CRS). The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community meeting the three goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating; and 3) promote the awareness of flood insurance. Table 5-1 identifies each community and the date each participant joined the NFIP.

Table 5-1: Additional Information on Communities Participating in the NFIP

Community	Participation Date	DFIRM Date	CRS Date	CRS Rating	Flood Plain Zoning Ordinance Adopted Last
Union County	11/29/1974	5/2/2008	NA	NA	5/5/2008
Village of Alto Pass		5/2/2008	NA	NA	NA
City of Anna		5/2/2008	NA	NA	NA
Village of Cobden		5/2/2008	NA	NA	NA
Village of Dongola		5/2/2008	NA	NA	NA
City of Jonesboro		5/2/2008	NA	NA	NA

5.1.2 Stormwater Management Stream Maintenance Ordinance

Union County nor its cities or villages have a storm water management plan or ordinances.

5.1.3 Zoning Management Ordinance

Union County nor its cities or villages have land use planning or zoning ordinances.

5.1.4 Erosion Management Program/ Policy

Union County utilizes the Illinois Administrative Code Title 35 and the Illinois Environmental Protection Act, administered by the Illinois Environmental Protection Agency. This requires the submission of a stormwater pollution prevention plan (SWPPP) for projects involving more than one acre of land disturbance.

5.1.5 Fire Insurance Rating Programs/ Policy

Table 5-2 lists the fire departments in Union County, as well as the ISO rating and the number of members in each department.

Table 5-2: Listing of Fire Departments, Ratings, and Number of Firefighters

Fire Department	Fire Insurance Rating	Number of Firefighters
Alto Pass Volunteer Fire Dept	6	14
Anna Fire Dept	7	20
Cobden Fire Dept	7/9	20
Dongola Auxiliary Fire Dept	6	19
Jonesboro Fire Dept	7	16
Ware-Wolf Lake Fire Dept	7/8	12

5.1.6 Land Use Plan

The land use planning for Union County is outlined in the Southern Five Comprehensive Economic Development Strategy (CEDS).

5.1.7 Building Codes

Union County and some of its communities have adopted the National Building Code and used Illinois Capital Development Board's Building Codes as its guide for public building standards. Many of the building codes for manufactured homes require tie-downs to minimize wind effects. There are no building codes specific to seismic control.

5.2 Mitigation goals

The Union County Emergency Management Agency, Southern Illinois University-Carbondale Geology Department, the Polis Group of IUPUI, and the Southern Five Regional Planning Commission assisted the Union County Multi-Hazard Mitigation Planning Team in the formulation of mitigation strategies and projects for Union County. The goals and objectives set forth were derived through participation and discussion of the views and concerns of the Union County Multi-Hazard Mitigation Team members and related public input. The MHMP will focus on these goals, with a great deal of public input, to ensure that the priorities of the communities are represented.

The goals represent long-term, broad visions of the overall vision the county would like to achieve for mitigation. The objectives are strategies and steps which will assist the communities to attain the listed goals. Table 5-4 lists mitigation actions, which are defined projects that will help to complete the defined goals and objectives.

Goal 1: Lessen the impacts of hazards to new and existing infrastructure

(a) Objective: Retrofit critical facilities and structures with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.

(b) Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.

(c) Objective: Minimize the amount of infrastructure exposed to hazards.

(d) Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.

(e) Objective: Improve emergency sheltering in Union County.

Goal 2: Create new or revise existing plans/maps for Union County

(a) Objective: Support compliance with the NFIP for each jurisdiction in Union County.

(b) Objective: Review and update existing, or create new, community plans and ordinances to support hazard mitigation.

(c) Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.

Goal 3: Develop long-term strategies to educate Union County residents on the hazards affecting their county

(a) Objective: Raise public awareness on hazard mitigation.

(b) Objective: Improve education and training of emergency personnel and public officials.

5.3 Mitigation Actions/Projects

Upon completion of the risk assessment and development of the goals and objectives, the Planning Committee was provided with a list of the six mitigation measure categories from the *FEMA State and Local Mitigation Planning How to Guides*. The measures are listed as follows.

- **Prevention:** Government, administrative, or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, structural retrofits, storm shutters, and shatter-resistant glass.
- **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

- **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.
- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

After Meeting #3, held February 4, 2009, MHMP members were presented with the task of individually listing potential mitigation activities using the FEMA evaluation criteria. The MHMP members brought their mitigation ideas to Meeting #4, which was held February 25, 2009. The evaluation criteria (STAPLE+E) involved the following categories and questions.

Social:

- Will the proposed action adversely affect one segment of the population?
- Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Technical:

- How effective is the action in avoiding or reducing future losses?
- Will it create more problems than it solves?
- Does it solve the problem or only a symptom?
- Does the mitigation strategy address continued compliance with the NFIP?

Administrative:

- Does the jurisdiction have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained?
- Can the community provide the necessary maintenance?
- Can it be accomplished in a timely manner?

Political:

- Is there political support to implement and maintain this action?
- Is there a local champion willing to help see the action to completion?
- Is there enough public support to ensure the success of the action?
- How can the mitigation objectives be accomplished at the lowest cost to the public?

Legal:

- Does the community have the authority to implement the proposed action?
- Are the proper laws, ordinances, and resolution in place to implement the action?
- Are there any potential legal consequences?
- Is there any potential community liability?
- Is the action likely to be challenged by those who may be negatively affected?
- Does the mitigation strategy address continued compliance with the NFIP?

Economic:

- Are there currently sources of funds that can be used to implement the action?
- What benefits will the action provide?
- Does the cost seem reasonable for the size of the problem and likely benefits?
- What burden will be placed on the tax base or local economy to implement this action?
- Does the action contribute to other community economic goals such as capital improvements or economic development?
- What proposed actions should be considered but be “tabled” for implementation until outside sources of funding are available?

Environmental:

- How will this action affect the environment (land, water, endangered species)?
- Will this action comply with local, state, and federal environmental laws and regulations?
- Is the action consistent with community environmental goals?

The development of the MHMP is the first step in a multi-step process to implement projects and policies to mitigate hazards in the county and its communities.

5.3.1 Completed or Current Mitigation Actions/Projects

Since this is the first mitigation plan developed for Union County, there are no deleted or deferred mitigation items. The following tables will refer to completed, ongoing, or future mitigation actions. Table 5-4 presents the completed and ongoing mitigation actions and projects in the county.

Table 5-4: Completed or Current Mitigation Actions

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Comments
Develop a program to distribute weather radios to all critical facilities	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Flood, Tornado, Thunderstorm, Winter Storm	Union County, Alto Pass, Anna, Cobden, Dongola, Jonesboro	Shawnee Development Council distributes radios to communities and critical facilities.
Establish agreements with communities to set up shelters	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Improve emergency sheltering in Union County.	Tornado, Thunderstorm	Union County, Alto Pass, Anna, Cobden, Dongola, Jonesboro	The Union County ESDA has established agreements.
Repair the Mississippi Levee to alleviate back flooding	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Flood	Union County	Clear Creek is installing an additional pipe through the levee to help with flooding.
Develop warming shelters throughout the county	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Improve emergency sheltering in Union County.	Winter Storm	Union County	This project is ongoing.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Comments
Trim trees to minimize the amount/duration of power outages	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Winter Storm	Union County	This project has been implemented and is ongoing.
Create a database for identification of special needs population and institute a plan for rescue and recovery	Goal: Develop long-term strategies to educate Union County residents on the hazards affecting their county Objective: Improve education and training of emergency personnel and public officials.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Union County	This project has been implemented. ESDA and the county sheriff are continuing to work on the project.
Implement Nixle for mass media release via e-mail and text messages	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Subsidence	Union County	The county currently uses Nixle.

5.4 Implementation Strategy and Analysis of Mitigation Projects

Implementation of the mitigation plan is critical to the overall success of the mitigation planning process. The first step is to decide based upon many factors, which action will be undertaken initially. In order to pursue the top priority first, an analysis and prioritization of the actions is important. Some actions may occur before the top priority due to financial, engineering, environmental, permission, and/or site control issues. Public awareness and input of these mitigation actions can increase knowledge to capitalize on funding opportunities and monitoring the progress of an action.

In Meeting #4, the planning team prioritized mitigation actions based on a number of factors. A rating of High, Medium, or Low was assessed for each mitigation item and is listed next to each item in Table 5-6. The factors were the STAPLE+E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria listed in Table 5-5.

Table 5-5: STAPLE+E planning factors

S – Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T – Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – Economic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.

E – Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.
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For each mitigation action related to infrastructure, new and existing infrastructure was considered. Additionally, the mitigation strategies address continued compliance with the NFIP. While an official cost benefit review was not conducted for any of the mitigation actions, the estimated costs were discussed. The overall benefits were considered when prioritizing mitigation items from High to Low. An official cost benefit review will be conducted prior to the implementation of any mitigation actions. Table 5-6 presents mitigation projects developed by the planning team.

Table 5-6: Mitigation Strategies

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Reestablish prevention posters and signs for wildland fires	Goal: Develop long-term strategies to educate Union County residents on the hazards affecting their county Objective: Raise public awareness on hazard mitigation.	Fire	Union County	Low	The county ESDA director will work with public officials to create and distribute the literature. Local resources will be used for funding. If funding is available, implementation will begin within five years.
Harden the bridges that cross major highways	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Retrofit critical facilities with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.	Earthquake	Union County	Medium	The county ESDA director will work with State and County Highway Departments and ILDOT on this project. Funding has not been secured as of 2010, but ILDOT and IEMA are possibilities. Implementation will begin within three years.
Install inertial valves on gas lines and backflow valves on sewer lines at critical facilities	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Retrofit critical facilities with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.	Earthquake	Union County	Medium	The county ESDA director will oversee implementation of this project. Funding has not been secured as of 2010, but the PDM program and community grants are an option. If funding is available, implementation will begin within three years.
Clear trees and debris from the ditch along Mississippi Levee and other county streams	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Flood	Union County	Medium	The county ESDA director and county engineer will work with the U.S. Army Corps of Engineers and IDNR to evaluate the current conditions of the county's waterways and develop a plan. Funding has not been secured as of 2010, but county, state, and federal funding will be sought. Implementation will begin within three years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Repair county roads that frequently flood	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Flood	Union County	Medium	The county ESDA director will oversee this project, working with highway departments. ILDOT, IEMA, and IDNR - potential funding sources. If funding is available, implementation will begin within three years.
Institute a buy-out plan for homes near Clear Creek	Goal: Create new or revise existing plans/maps for Union County Objective: Support compliance with the NFIP for each jurisdiction in Union County.	Flood	Union County	High	The County ESDA director and floodplain manager will oversee the implementation of the project. Funding has not been secured as of 2010 but will be sought from funding sources such as IEMA. Implementation, if funding is available, is forecasted to begin within one year.
Purchase generators with transfer switches for critical facilities	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Tornado, Thunderstorm	Union County, Alto Pass, Anna, Cobden, Dongola, Jonesboro	High	The County ESDA director oversees the implementation of the project. Funding has not been secured as of 2010 but will be sought from funding sources such as IEMA. Implementation, if funding is available, is forecasted to begin within one year.
Update/create new EAPs, especially for State Pond	Goal: Create new or revise existing plans/maps for Union County Objective: Review and update existing community plans and ordinances to support hazard mitigation.	Flood	Union County	High	The County ESDA director will work with dam owners to oversee implementation of this project. Funding has not been secured as of 2009, but local resources are potential sources. Implementation, if funding is available, will begin within one year.
Establish an LEPC	Goal: Develop long-term strategies to educate Union County residents on the hazards affecting their county Objective: Improve education and training of emergency personnel and public officials	Flood, Tornado, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire	Union County	High	The County ESDA director will work with local first responders to research training opportunities. The county will request funding for training and equipment from IEMA. If funding is available, implementation will begin within one year.
Develop a public education program to explain hazard communications, emergency plans (including disaster kits), and non-structural practices, e.g. bolting bookshelves to walls	Goal: Develop long-term strategies to educate Union County residents on the hazards affecting their county Objective: Raise public awareness on hazard mitigation.	Flood, Tornado, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire	Union County, Alto Pass, Anna, Cobden, Dongola, Jonesboro	Medium	The County ESDA director will oversee this project. Local resources, such as railroad/train companies and schools, will be used to develop educational literature and present to each jurisdiction at public events or in schools. If resources are available, the project will be implemented within three years
Conduct a commodity flow study	Goal: Create new or revise existing plans/maps for Union County Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.	Hazmat	Union County	Medium	Community planners and local government leaders will coordinate this study. Funding will be requested from community grants or IEMA. Implementation will begin within three years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Develop a forest wildfire mitigation plan – Community Wildland Fire Mitigation Plan	Goal: Create new or revise existing plans/maps for Union County Objective: Review and update existing community plans and ordinances to support hazard mitigation.	Fire	Union County	Low	The county ESDA director will oversee the implementation of this project. Local resources, including the planning commission, will be used to develop the plan. Implementation will begin within five years.
Develop a debris management plan	Goal: Create new or revise existing plans/maps for Union County Objective: Review and update existing community plans and ordinances to support hazard mitigation.	Fire, Tornado, Thunderstorm	Union County	Medium	The County ESDA director will oversee the implementation of this project. Local resources, including the planning commission, will be used to develop the plan. Implementation will begin within three years.
Procure appropriate training and equipment for first responders	Goal: Develop long-term strategies to educate Union County residents on the hazards affecting their county Objective: Improve education and training of emergency personnel and public officials	Earthquake, Hazmat	Union County	Medium	Currently the county relies on a regional HAZMAT team to provide first responders for . The county ESDA director will work with local first responders to develop a team. The county will request funding for training and equipment from IEMA. If funding is available, implementation will begin within one year.
Bury major power lines	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Winter Storm	Union County	Low	The County ESDA director, municipalities, and utility companies will oversee the implementation of this project. Local and corporate resources will be used to prioritize power lines and bury them. The project is forecasted to be complete within approximately five years.
Construct an overpass or underpass for the railroad crossing in Anna	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.	Hazmat	Anna	Low	The County ESDA director will work with ILDOT on the possibility of construction. Funding has not been secured as of 2009, but ILDOT is a possible source. If funding is available, the project is forecasted to begin within five years.
Integrate the Aloha software with E911 system for hazmat warning	Goal: Create new or revise existing plans/maps for Union County Objective: Review and update existing community plans and ordinances to support hazard mitigation.	Hazmat	Union County	Low	The County ESDA director will coordinate this planning effort. Local resources will be used to review existing systems and research new options. Implementation will begin within five years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Install a system of multi-disaster warning sirens	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.	Tornado, Flood, Thunderstorm, Winter Storm	Cobden, Alto Pass, Dongola, Mill Creek	High	The County ESDA director oversees the implementation of the project. Local resources will be used to evaluate and maintain the warning systems. Additional funding will be sought from other funding sources, e.g. PDM program, to expand the warning system coverage area. Implementation, if funding is available, is forecasted to begin within one year.
Establish shelters in each of the incorporated communities	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Improve emergency sheltering in Union County.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Union County, Alto Pass, Anna, Cobden, Dongola, Jonesboro	Low	The County ESDA director will oversee the implementation of this project. Local resources and IEMA grants will be sought to procure the materials. Implementation, if funding is available, is forecasted to begin within five years.
Identify alternate routes to use in case of road closure	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.	Tornado, Thunderstorm, Flood, Earthquake, Winter Storm, Hazmat, Fire	Union County	Low	The County ESDA director will work with the highway department and GIS specialists to determine alternate routes. Local resources will be used for funding. Implementation will begin within five years.
Purchase new snow removal equipment, including 4X4 wheel drive vehicles	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Winter Storm	Union County	Medium	The County ESDA director will oversee this project. Funding has not been secured as of 2009, but the PDM program and community development grants are a possibility. If funding is available, implementation will begin within three years.

The Union County Emergency Management Agency will be the local champions for the mitigation actions. The county commissioners and the city and town councils will be an integral part of the implementation process. Federal and state assistance will be necessary for a number of the identified actions. Southern Five Regional Planning District and Development Commission is qualified to provide technical grant writing services to assist the county in seeking resources to achieve the recommended mitigation action.

5.5 Multi-Jurisdictional Mitigation Strategy

As a part of the multi-hazard mitigation planning requirements, at least two identifiable mitigation action items have been addressed for each hazard listed in the risk assessment and for each jurisdiction covered under this plan.

Each of the six jurisdictions, including Union County, were invited to participate in brainstorming sessions in which goals, objectives, and strategies were discussed and prioritized. Each participant in these sessions was armed with possible mitigation goals and strategies

provided by FEMA, as well as information about mitigation projects discussed in neighboring communities and counties. All potential strategies and goals that arose through this process are included in this plan. The county planning team used FEMA's evaluation criteria to gauge the priority of all items. A final draft of the disaster mitigation plan was presented to all members to allow for final edits and approval of the priorities.

Section 6 - Plan Maintenance

6.1 Monitoring, Evaluating, and Updating the Plan

Throughout the five-year planning cycle, the Union County Emergency Services and Disaster Agency Director will reconvene the MHMP planning committee to monitor, evaluate, and update the plan on an annual basis. Additionally, a meeting will be held during March 2015 to address the five-year update of this plan. Members of the planning committee are readily available to engage in email correspondence between annual meetings. If the need for a special meeting arises, due to new developments or a declared disaster, the team will meet as necessary to update mitigation strategies. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented independently by individual communities or through local partnerships.

The committee will review the county goals and objectives to determine their relevance to changing situations in the county. In addition, state and federal policies will be reviewed to ensure they are addressing current and expected conditions. The committee will also review the risk assessment portion of the plan to determine if this information should be updated or modified. The parties responsible for the various implementation actions will report on the status of their projects and will include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

Updates or modifications to the MHMP during the five-year planning process will require a public notice and a meeting prior to submitting revisions to the individual jurisdictions for approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by the county commissioners.

The GIS data used to prepare the plan was obtained from existing county GIS data as well as data collected as part of the planning process. This updated HAZUS-MH GIS data has been returned to the county for use and maintenance in the county's system. As newer data becomes available, this updated data will be used for future risk assessments and vulnerability analyses.

6.2 Implementation through Existing Programs

The results of this plan will be incorporated into ongoing planning efforts. Many of the mitigation projects identified as part of this planning process are ongoing. Where needed, modifications will be made to the county and community planning documents and ordinances as part of regular updates. The mitigation plan will be used to help guide building code changes and land use planning.

6.3 Continued Public Involvement

Continued public involvement is critical to the successful implementation of the MHMP. Comments from the public on the MHMP will be received by Union County Emergency Services and Disaster Agency and forwarded to the MHMP planning committee for discussion. Education efforts for hazard mitigation will be ongoing through the local television stations,

brochures, and yearly public meetings. Once adopted, a copy of this plan will be posted in the library and on the county website.

Glossary of Terms

[A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)

A

AEGL – Acute Exposure Guideline Levels
ALOHA – Areal Locations of Hazardous Atmospheres

B

BFE – Base Flood Elevation

C

CAMEO – Computer-Aided Management of Emergency Operations
CEMA – County Emergency Management Agency
CEMP – Comprehensive Emergency Management Plan
CERI – Center for Earthquake Research and Information
CRS – Community Rating System

D

DEM – Digital Elevation Model
DFIRM – Digital Flood Insurance Rate Map
DMA – Disaster Mitigation Act

E

EAP – Emergency Action Plan
ERPG – Emergency Response Planning Guidelines
EMA – Emergency Management Agency
EPA – Environmental Protection Agency
ESDA - Emergency Service Disaster Agency

F

FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Maps
FIS – Flood Information Study

G

GIS – Geographic Information System

H

HAZUS-MH – **H**azards **USA** **M**ulti-**H**azard
HUC – Hydrologic Unit Code

I

IDNR – Illinois Department of Natural Resources
IEMA – Illinois Emergency Management Agency

M

MHMP – Multi-Hazard Mitigation Plan

N

NCDC – National Climatic Data Center
NEHRP – National Earthquake Hazards Reduction Program
NFIP – National Flood Insurance Program
NOAA – National Oceanic and Atmospheric Administration

P

PPM – Parts Per Million

R

RPI – Risk Priority Index

S

SPC – Storm Prediction Center
SWPPP – Stormwater Pollution Prevention Plan

U

USGS – United States Geological Survey

Appendix A – Minutes of the Multi-Hazard Mitigation Planning Team Meetings

Example of Letter of Invitation for Participation in the Union County Pre-disaster Mitigation Plan.

Note, the Village of Mill Creek did not responded to the offer to participate in the Union County Pre-disaster Mitigation Plan.



June 30, 2009

Village President
Village of Mill Creek
P.O. Box 201
Mill Creek, IL 62961

Dear Village President:

This letter is to inform you that you are invited to a meeting scheduled on **Thursday, July 9th, 2009 at 6pm** at the **Sunshine Inn Senior's Center in Anna**. This meeting is a Public Meeting where all of the public is invited to review the Draft Plan of the Pre-Disaster Mitigation Project that Union County has been participating in. Southern Five RPC, along with staff at Southern Illinois University, has been assisting Union County in putting this plan together.

The Committee for Union County was assembled in order to put together a Disaster Plan for the County and its municipalities with the assistance of SIU. And since this is a FEMA funded project, this meeting is required by the terms of the grant. We need as much input from all of the communities and their officials as possible. This whole planning process is **very important** because if the County and all municipalities do not follow through with the plan and have interested parties at these meetings, then the County or municipalities **WILL NOT be eligible for future FEMA funds if a disaster would strike**.

If you have any questions, please feel free to call me at 618.634.2284. Thank you.

Sincerely,



Crystal Davenport
Regional Planner

IEMA Pre-Disaster Mitigation Plan

Assembly of the Union County Planning Team Meeting 1:

Chairman: Dana Pearson, Union County ESDA

**Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department,
and IUPUI - Polis**

Meeting Date: Tuesday, October 28, 2008

Meeting Time: 11:30 am

Place: The Brickhouse Restaurant, Anna, IL

Planning Team/Attendance:

Jonathan Remo	SIUC Geology
Andy Flor	SIUC Geology
John Beuchler	IUPUI – Polis
Dave Coats	IUPUI – Polis
Crystal Davenport	Southern Five Regional Planning Commission
Larry Nance	Village of Cobden
Todd Harris	Ware-Wolf Lake Fire Dept
Michael Stoner	Anna Fire Dept
Al Kamp	Anna Police Dept
Dana Pearson	Union County ESDA Director
Jana Fear	Union County 911
Crystal Gurley	Alto Pass Fire Dept
David Livesay	Union County Sheriff's Office
Bill Ecker	City of Jonesboro
Mike Yates	Union County Highway Dept
Jim Watkins	City of Jonesboro
Bill Jackson	City of Anna

Introduction to the Pre-Disaster Mitigation Planning Process

The meeting is called to order

Narrative: A power-point presentation was given by Jonathan Remo. He explained that this project is in response to the Disaster Mitigation Act of 2000. The project is funded by a grant awarded by FEMA. A twenty-five percent match will be required from the county to fund this project. The county match will be met by sweat equity and GIS data acquired from the County Assessor's Office. The sweat equity will be an accumulation of time spent at the meetings, on research assignments, surveys, along with the time spent reviewing and producing the planning document.

Jonathan Remo introduced the Pre-Disaster Mitigation Website to the planning team. A username and password was given to the planning team, which will grant them access to the web site. The web site is used to schedule meetings, post contact information and download material pertaining to the planning process.

Jonathan Remo divided the planning project into five to six meetings. At the 1st meeting, the planning team will review critical facility maps. The planning team will be asked to research and verify the location of all critical facilities within the county. Jonathan stated that public participation is very important throughout the planning process. He explained that all of the meetings are open to the public but there will be a particular effort made to invite the public to the 3rd meeting. At that meeting, the SIUC Geology Department will present historic accounts of natural disasters that have affected this area. At the 2nd meeting the discussion will focus on natural disasters that are relevant to this area. These hazards will be given a probability rating and ranked by their occurrence and potential level of risk. Polis and SIUC Geology will research these hazards and present them to the planning team. The 3rd meeting is publicized in order to encourage public participation. Polis and SIUC Geology will produce a risk assessment in draft form; each planning team member will get a copy. Also they will present strategies and projects that FEMA and other counties have undertaken for the planning team to review. The 4th meeting consists of a brain storming session focused on disasters that were analyzed in the risk assessment report. The Planning Team will list strategies and projects that could be implemented to mitigate the potential hazards that threaten the county. FEMA requires that for every identified hazard, a strategy to mitigate the loss and damage must be in place. The strategies may range from educational awareness to hardening a building or building a levee. After the 4th meeting the plan will be in its final draft form. At the 5th meeting the planning team will need to review the plan prior to sending it to IEMA. IEMA will review the plan and will make recommendation to it as they see fit, then it is submitted to FEMA for review and approval. Once the plan has been submitted to FEMA, local governments are eligible to apply for grants to mitigate these established hazards. After FEMA approves the plan, it is sent back to the Planning Team. At the 6th meeting the Planning Team will present the Pre-Disaster Mitigation Plan to the County Board for adoption. Incorporated communities must either adopt the county plan or prepare its own plan, in order to access mitigation assistance from FEMA. The communities are encouraged to participate and contribute to development of the plan. Once the County Board has adopted the plan, each incorporated community will have the opportunity to adopt the plan as well.

Jonathan Remo then introduced Andy Flor of SIUC. Andy Flor presented three maps that identified critical facilities in the county. He asked the planning team to come up to review the maps to identify any corrections that need to be made to the maps. He assigned research homework arranged by categories to individual planning team members to locate missing or incorrect critical facilities.

Narrative: A few clarifications were made about the planning process and the participation needed to complete the plan along with dialog between the Planning Team members and Andy and Jonathan about the critical facilities maps. There was discussion

about the communities that were not represented and how to contact those communities for the meetings. It was also made known by Crystal Davenport of Southern Five Regional Planning Commission that all of the planning team members would be notified of the next meeting time and place.

Meeting was adjourned.

Tues, Oct 28th 2008, 11:30 AM
BRICKHOUSE RESTAURANT

Union County Meeting #1

<u>NAME</u>	<u>PHONE</u>	<u>EMAIL</u>
LARRY E. NANCE	Village of Cobden 893-2425	
TODD HARRIS	618-203-6406 - cell	toddharris@directmail.com
MICHAEL STONER	618-697-3201	1LTYRKYTR@yahoo.com
al Kamp	618-697-0828	V2WINGS@VERIZON.NET
Dana Pearson	618-697-0760	Lefty73@verizon.net
Jana Fear	618-833-5442	unionco911@yahoo.com
Crystal Gurley	618-833-5442	bumpcrys@hotmail.com
DAVID LIVESAY	618-833-5500	ucso091@MAIL.COM
Jonathan Remo	618-453-7370	dianict@siv.edu
John Buechler	317-278-2433	Jobuechl@ivpu.edu
BILL ECKER	618-833-2858	
ANDY FLOR	618-453-7370	flojo@siv.edu
MIKE YATES	618-833-2912	Myates@AJInternet.net
JIM WATKINS	618-833-8429	JimNANI@Verizon.NET
CRISTAL DAVENPORT	618-634-2284	cdaven@southernfive.org
BILL JACKSON	618-833-2525	UCPRESS@AJINTERNET.NET

IEMA Pre-Disaster Mitigation Plan

Assembly of the Union County Planning Team Meeting 2:

Chairman: Dana Pearson, Union County ESDA

**Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department,
and IUPUI - Polis**

Meeting Date: Thursday, December 11, 2008

Meeting Time: 1 pm

Place: The Brickhouse Restaurant, Anna, IL

Planning Team/Attendance:

Jonathan Remo	SIUC Geology
Andy Flor	SIUC Geology
Lisa Thurston	Southern Five Regional Planning Commission
Mike Yates	Union County Highway Dept
Bill Jackson	City of Anna
Scott Crist	USDA Forest Service
Jim Watkins	City of Jonesboro
Bill Ecker	City of Jonesboro
Michael Stoner	City of Anna Fire Dept
Jana Fear	Union County 911
Crystal Gurley	Alto Pass Fire Dept
Jack Martell	Village of Cobden
Dana Pearson	Union County ESDA Director

The meeting was called to order.

Jonathan Remo began the meeting by re-introducing the objectives of the PDM Planning document. The planning document is mandated as a result of the “Disaster Mitigation Act of 2000”. Jonathan stated that the objective of the meeting was to prioritize a list of disasters that are relevant to Johnson County.

Jonathan Remo provided the planning team with a handout to direct the focus of the meeting discussion. As Jonathan began to conduct the prioritizing process, he described the risk assessment ranking that FEMA has established.

Narrative: The Planning Team was then asked to assess a risk level to each disaster that was identified in Union County. The risk level is ranked as followed:

- #1: Tornado**
- #2: Earthquake**
- #3: Dam or Levee Failure**

- #4: Thunderstorms/High Winds/Hail/Lightening**
- #5: Transportation Hazardous Material Release**
- #6: Winter Storms**
- #7: Flooding**
- #8: Wildfire/Fire/Explosion**

Narrative: The planning team was then asked to analyze the historical weather events that have been plotted on a map of the county and communities therein. No corrections were noted by the planning team.

The planning team agreed to complete any missing information pertaining to critical facilities by the next meeting.

Meeting was adjourned.

Union
County

Mitg #2

Pre-Disaster Hazard Mitigation 12/11/08

- 1 Mike Yates Union County Highway
- 2 Bill Jackson
- 3 Scott Crist USDA Forest Service, Shawnee NF ⁶¹⁸⁻⁶⁸⁷⁻¹⁷³¹ _{scrist@fs.fed.us}
- 4 Jim Watkins City of Jonesboro
- 5 Bill Ecker " " "
- 6 Michael Stover City of Anna Fire Dept.
- 7 Janae Fear Union Co 9-1-1
- 8 Crystal Curley Alto Pass Fire Dept.
- 9 Jack Martell Village of Cobden
- 10 Andy Fear SIUC
- 11 Jonathan Remo SIUC
- 12 Dana Pearson ESDA
- 13 Lisa Thuston SFRPC

IEMA Pre-Disaster Mitigation Plan

Assembly of the Union County Planning Team Meeting 3:

Chairman: Dana Pearson, Union County ESDA

**Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department,
and IUPUI – Polis**

Meeting Date: Thursday, July 9, 2009

Meeting Time: 6 pm

Place: Sunshine Inn, Anna, IL

Planning Team/Attendance:

Jonathan Remo	SIUC Geology
Crystal Davenport	Southern Five Regional Planning Commission
David Livesay	Union County Sheriff's Office
Crystal Gurley	Alto Pass Fire Dept
Jana Fear	Union County 911
Bill Jackson	City of Anna
Tammie Aden	Village of Dongola
Dale Aden	Village of Dongola
Todd Harris	Ware-Wolf Lake Fire Dept
Dana Pearson	Union County ESDA Director
Larry Nance	Village of Cobden
Don Rehmer	Village of Alto Pass
Mike Yates	Union County Highway

The meeting was called to order.

Jonathan Remo opened the meeting with an overview of the planning process and the roles of SIU and the Polis Center. Then he went on to explain the topics and objectives of the current meeting. Jonathan first presented the planning team with the list of hazards that the team had ranked by their level of risk from the previous meeting. He also presented a power point presentation of the history of Union County's past disasters. This included covering each hazard that the County had focused on, the history of each and then the mitigation strategies. He defined mitigation as the act of avoidance and preparedness.

A copy of Mitigation Idea, produced by FEMA Region 5 in July 2002, was given to each of the planning team members for review. It was explained by Jonathan the contents of the booklet and that each of the planning team members should return to meeting 4 with three mitigation strategies for each of the hazards identified by the planning team.

Jonathan Remo then asked the audience for questions or comment. After some discussion about the plan and how it would affect the community and its residents, he thanked those who came and a closed the presentation.

Meeting was adjourned.

SIGN IN SHEETPLACE: Sunshine Inn, Anna, ILDATE: July 9, 2009TIME: 6:00 pmPURPOSE: Public Hearing for Multi-Hazard Mitigation Plan - Union County (#3)NAMEADDRESS

DAVID LUESAY	307 WEST MARKET ST. JONESBORO IL
Crystal Gurley	UNION CO. SHERIFF OFFICE
Janae Fear	307 W. Market St Jonesboro IL
Bill Jackson	Alto Pass Fire Dept
Tammie Aden	307 W. Market St Rm 102 Jonesboro IL
DALE ADEW	Union Co 9-1-1
TODD HARRIS	108 W. VIENNA ST. Anna IL
Dana Pearson	102 BON LN Dongola IL 62926
LARRY E. NANCE	102 BON LN Dongola IL
Don Rehmer	375 West St Ware-Wolf Lake
MIKE YATES	WARE-WOLF LAKE IL 62998 Fire Dept
CRYSTAL DAVENPORT	155 Wrights Crossing Rd. Cobden, IL 62920
JONATHAN REMO	2715 ST. RT. 124 N Cobden, IL 62920
	Village of Alto Pass - Mayor
	P.O. Box 98 Alto Pass IL 62905
	306 MISSISSIPPI ST JONESBORO IL
	SFRPC
	SIUC

IEMA Pre-Disaster Mitigation Plan**Assembly of the Union County Planning Team Meeting 4:****Chairman: Dana Pearson, Union County ESDA****Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department,
and IUPUI – Polis****Meeting Date: Tuesday, September 22, 2009****Meeting Time: 10 am****Place: Anna City Hall Council Room, Anna, IL****Planning Team/Attendance:**

**Jonathan Remo
John Buechler
Crystal Davenport
Alan Eddington
Jim Watkins
Bill Ecker
David Livesay
Crystal Gurley
Jana Fear
Dana Pearson
Bill Jackson
Scott Crist**

**SIUC Geology
IUPUI – Polis
Southern Five Regional Planning Commission
Village of Cobden
City of Jonesboro
City of Jonesboro
Union County Sheriff's Office
Alto Pass Fire Dept
Union County 911
Union County ESDA Director
City of Anna
US Forest Service**

The meeting was called to order.

Jonathan Remo thanked everyone for attending the meeting and stated that if the planning team members needed extra mitigation strategy handbooks that they were available upon request. He introduced John Buechler from the Polis Center that was in attendance that day also.

John Buechler began by explaining that today's meeting would cover mitigation strategies that the planning team believed would prevent or eliminate the loss of life and property. He explained that the planning team should not make any reservations in the form of money or resources when developing this list. Also whenever possible, the planning team was directed to be specific about the location or focus area of a strategy, in respect to being within a municipality or county wide. Each hazard was addressed one at a time. The planning team listed new and current on-going mitigation strategies in respect to each hazard. The planning team prioritized mitigation actions based on a number of factors. A rating of High, Medium, or Low was assessed for each mitigation item. Listed below are the New Mitigation Strategies that the Planning Team came up with:

Mitigation Item	Hazards Addressed	Jurisdictions Covered	Priority
Reestablish prevention posters and signs for wildland fires	Fire	Union County	Low
Harden the bridges that cross major highways	Earthquake	Union County	Medium
Install inertial valves on gas lines and backflow valves on sewer lines at critical facilities	Earthquake	Union County	Medium
Clear trees and debris from the ditch along Mississippi Levee and other county streams	Flood	Union County	Medium
Repair county roads that frequently flood	Flood	Union County	Medium
Institute a buy-out plan for homes near Clear Creek	Flood	Union County	High
Purchase generators with transfer switches for critical facilities	Tornado, Thunderstorm	Union County, Alto Pass, Anna, Cobden, Dongola, Jonesboro	High
Update/create new EAPs, especially for State Pond	Flood	Union County	High

Mitigation Item	Hazards Addressed	Jurisdictions Covered	Priority
Establish an LEPC	Flood, Tornado, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire	Union County	High
Develop a public education program to explain hazard communications, emergency plans (including disaster kits), and non-structural practices, e.g. bolting bookshelves to walls	Flood, Tornado, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire	Union County, Alto Pass, Anna, Cobden, Dongola, Jonesboro	Medium
Conduct a commodity flow study	Hazmat	Union County	Medium
Develop a forest wildfire mitigation plan – Community Wildland Fire Mitigation Plan	Fire	Union County	Low
Develop a debris management plan	Fire, Tornado, Thunderstorm	Union County	Medium
Procure appropriate training and equipment for first responders	Earthquake, Hazmat	Union County	Medium
Bury major power lines	Winter Storm	Union County	Low
Construct an overpass or underpass for the railroad crossing in Anna	Hazmat	Anna	Low
Integrate the Aloha software with E911 system for hazmat warning	Hazmat	Union County	Low
Install a system of multi-disaster warning sirens	Tornado, Flood, Thunderstorm, Winter Storm	Cobden, Alto Pass, Dongola, Mill Creek	High

Mitigation Item	Hazards Addressed	Jurisdictions Covered	Priority
Establish shelters in each of the incorporated communities	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Union County, Alto Pass, Anna, Cobden, Dongola, Jonesboro	Low
Identify alternate routes to use in case of road closure	Tornado, Thunderstorm, Flood, Earthquake, Winter Storm, Hazmat, Fire	Union County	Low
Purchase new snow removal equipment, including 4X4 wheel drive vehicles	Winter Storm	Union County	Medium

SIGN IN SHEET

PLACE: Anna City Hall Council Room, Anna, IL

DATE: September 22, 2009

TIME: 10:00 am

PURPOSE: Union Co Pre Disaster Mitigation Committee Meeting #4

[illegible]

IEMA Pre-Disaster Mitigation Plan

Assembly of the Union County Planning Team Meeting 5:

Chairman: Dana Pearson, Union County ESDA Director

**Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department,
and IUPUI – Polis**

Meeting Date: Tuesday, March 9, 2010

Meeting Time: 10 am

Place: Anna City Hall meeting room, Anna, IL

Planning Team/Attendance:

**Jonathan Remo
Crystal Davenport
Bill Ecker
Larry Nance
Mike Yates
Michael Stoner
Dana Pearson
Bill Jackson**

**SIUC Geology
Southern Five Regional Planning Commission
City of Jonesboro
Village of Cobden
Union County Highway Dept
Anna Fire Dept
Union Co ESDA
Private Citizen, Anna**

The meeting was called to order.

Jonathan Remo opened the meeting with an overview of what was to happen from this point on with the plan. He stated that the plan could be reviewed by the Planning Team members for about 2 weeks so everyone would have ample amount of time look at and review the plan for any discrepancies. He also stated that in approximately 3 weeks the plan would be sent to IEMA/FEMA. They would then review it and if everything is OK with the plan, then we should hear back from IEMA/FEMA hopefully by May for their approval.

Jonathan then explained that once it comes back approved, then a Resolution will have to be passed by all municipalities. He stated that Crystal Davenport of Southern Five RPC will have an example of this resolution that she will give to the municipalities in order for them to pass it at their board/council meetings. After they are passed, Jonathan stated that they needed to be returned to Crystal and she will forward them on to FEMA. Once FEMA gets the Resolutions, they will send notification that the municipality has a completed and approved plan.

He also explained that once the plan is submitted to IEMA/FEMA for their review, the municipalities can begin formulating and putting together their projects for funding. There is a pool of funds from FEMA that these lower five counties can access that was

allowed for the '08 winter/ice storm that is earmarked just for the lower counties of IL. The projects must be related to the affects of this storm. He stated that if individuals wanted more specific information of this funding, they could go to the IEMA website.

It was also explained to the planning team that FEMA will require a five-year update to the plan. Jonathan told the planning team that in another five years, the members should come together again, most likely under the direction of the ESDA Director, to review the plan and make any necessary changes to it. He explained that FEMA will probably send out a reminder as to when this is supposed to take place.

After Jonathan explained the above process, he pointed out specific tables and places in the plan that needed clarification from the team members. After discussing a few changes, the planning team members looked at the plan for a while longer.

Since there were no more comments about the plan, the meeting was adjourned.

SIGN IN SHEETPLACE: Anna City Hall Meeting Room, Anna, ILDATE: March 9, 2010TIME: 10 amPURPOSE: Union County Pre-Disaster Mitigation Committee Meeting #5

<u>NAME</u>	<u>AFFILIATION</u>	<u>PHONE & EMAIL</u>
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BILL ECKER	CITY OF JORDON	833-2818
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LARRY NANCE	Village of Cobden	895-2425
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MIKE YATES	Union County Highway	833-2912
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MICHAEL STONER	Anna Fire Dept.	833-2231
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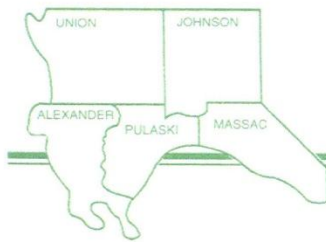
Dana Pearson	ESDA Director	697-0760
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Bill Jackson	Innovative	833-2525
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CRYSTAL DAVENPORT	SFRPC	
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JONATHAN REMO	SIUC	
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Example of letter of invitation to participate in the Union County pre-disaster mitigation planning process.



**Southern Five Regional Planning District
and Development Commission**

219 Rustic Campus Dr • Ullin, IL 62992 • (618) 634-2284 • Fax (618) 634-2287

June 30, 2009

Village President
Village of Mill Creek
P.O. Box 201
Mill Creek, IL 62961

Dear Village President:

This letter is to inform you that you are invited to a meeting scheduled on **Thursday, July 9th, 2009 at 6pm** at the **Sunshine Inn Senior's Center in Anna**. This meeting is a Public Meeting where all of the public is invited to review the Draft Plan of the Pre-Disaster Mitigation Project that Union County has been participating in. Southern Five RPC, along with staff at Southern Illinois University, has been assisting Union County in putting this plan together.

The Committee for Union County was assembled in order to put together a Disaster Plan for the County and its municipalities with the assistance of SIU. And since this is a FEMA funded project, this meeting is required by the terms of the grant. We need as much input from all of the communities and their officials as possible. This whole planning process is **very important** because if the County and all municipalities do not follow through with the plan and have interested parties at these meetings, then the County or municipalities **WILL NOT be eligible for future FEMA funds if a disaster would strike**.

If you have any questions, please feel free to call me at 618.634.2284. Thank you.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Crystal Davenport', written over a horizontal line.

Crystal Davenport
Regional Planner

Appendix B: Local Newspaper Articles

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**PUBLIC
NOTICE**

PUBLIC MEETING NOTICE

The Union County Pre-Disaster Mitigation Committee would like to invite everyone to a public meeting on Thursday, July 9, 2009, at 6 p.m. at the Sunshine Inn Senior's Center in Anna. This meeting is to inform the public of the potential disasters that could strike the county, the losses expected from those disasters and how to reduce the vulnerability to these disasters. FEMA/IEMA is the funding agency of this mitigation plan for the County. All are invited to attend this informative meeting. Faculty members of Southern Illinois University at Carbondale will be the presenters at this meeting.

27g

The Gazette-Democrat
online:
www.annanews.com

Appendix C: Adopting Resolutions

Resolution # _____

ADOPTING THE UNION COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, Union County recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, Union County participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Union County Commissioners hereby adopt the Union County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED that the Southern Five Regional Planning District and Development Commission will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Illinois Emergency Management Agency and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

County Commissioner Chairman

County Commissioner

County Commissioner

Attested by: County Clerk

Resolution # _____

ADOPTING THE UNION COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the City of Anna recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the City of Anna participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the City of Anna hereby adopts the Union County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Southern Five Regional Planning District and Development Commission will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Illinois Emergency Management Agency and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

City Mayor

City Council Member

City Council Member

City Council Member

City Council Member

Attested by: City Clerk

Resolution # _____

ADOPTING THE UNION COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the City of Jonesboro recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the City of Jonesboro participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the City of Jonesboro hereby adopts the Union County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that Southern Five Regional Planning District and Development Commission will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Illinois Emergency Management Agency and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

City Mayor

City Council Member

City Council Member

City Council Member

City Council Member

Attested by: City Clerk

Resolution # _____

ADOPTING THE UNION COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Village of Alto Pass recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Village of Alto Pass participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Village of Alto Pass hereby adopts the Union County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that Southern Five Regional Planning District and Development Commission submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Illinois Emergency Management Agency and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

Village President

Village Council Member

Village Council Member

Village Council Member

Village Council Member

Attested by: Village Clerk

Resolution # _____

ADOPTING THE UNION COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Village of Cobden recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Village of Cobden participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Village of Cobden hereby adopts the Union County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that Southern Five Regional Planning District and Development Commission will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Illinois Emergency Management Agency and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

Village President

Village Council Member

Village Council Member

Village Council Member

Village Council Member

Attested by: Village Clerk

Resolution # _____

ADOPTING THE UNION COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Village of Dongola recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Village of Dongola participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Village of Dongola hereby adopts the Union County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that Southern Five Regional Planning District and Development Commission will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Illinois Emergency Management Agency and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

Village President

Village Council Member

Village Council Member

Village Council Member

Village Council Member

Attested by: Village Clerk

Appendix D: Union County Historical Disaster Pictures and NCDC Historical Hazards

Appendix D - Union County Historical Hazards

Union County Photo Index

Included in this document are the photos, date of events, type of events and description. In the addition to this document there should be attachments to the email with a pdf or jpg form of each of the pictures. Note: the size of the picture seen in this index is usually not the actual size of the photo.

Thunderstorm/ High Winds/ Hail/ Lightning



File: Wind_may_2009

Date: Friday, May 8, 2009

Description: A crew from the City of Anna worked to remove a large tree limb which fell along West High Street during the storm which struck the Union County area last Friday afternoon.

Source: *The Gazette-Democrat*, Volume 160, Number 20, 2009 Reppert Publications



File: Wind2_may_2009

Date: Friday, May 8, 2009

Description: A utility pole along West Spring Street in Anna was snapped during last Friday's storm.

Source: *The Gazette-Democrat*, Volume 160, Number 20, 2009 Reppert Publications



File: Wind3_may_2009

Date: Saturday, May 9, 2009

Description: Heavy traffic was common last Friday and Saturday in Union County as motorists came from areas hit hard by Friday's storm to purchase gasoline and food. This was the scene near the BP station in Anna around midday Saturday. Similar scenes were spotted in Cobden and Jonesboro.

Source: *The Gazette-Democrat*, Volume 160, Number 20, 2009 Reppert Publications



File: Wind4_may_2009

Date: Friday, May 8, 2009

Description: An Illinois Department of Transportation vehicle stopped along old U.S. Route 51 in the Crowell Heights area north of Anna around midday Friday so a worker could clear a clogged ditch.

Source: *The Gazette-Democrat*, Volume 160, Number 20, 2009

Reppert Publications



File: Wind5_may_2009

Date: Friday, May 8, 2009

Description: Students and staff made their way through a darkened hallway at Cobden High School early Friday afternoon. Power was interrupted by stormy weather.

Source: *The Gazette-Democrat*, Volume 160, Number 20, 2009



File: Wind6_may_2009

Date: Friday, May 8, 2009

Description: A line of clouds which swept across the sky last Friday afternoon was seen at the same time that severe weather struck areas just north of Union County. This image was captures at Immanuel Baptist Church, which is located

just south of Cobden. **Source:** *The Gazette-Democrat*, Volume 160, Number 20, 2009



File: Wind7_may_2009

Date: Friday, May 8, 2009

Description: Stop signs were placed at the intersection of South Main and Jefferson streets after Friday's storm knocked out traffic signals in Anna.

Source: *The Gazette-Democrat*, Volume 160, Number 20, 2009

Tornados



File: Tornado_Apr_2002

Date: April 28, 2002

Description: Union and Johnson County, IL Storm Assessment photos

Source: <http://www.crh.noaa.gov/pah/storm/union/damage.php>



File: Tornado_Jan_1999

Date: January 21, 1999

Description: Photo taken between Thebes (Alexander County) and McClure (Union County) in Southern Illinois. Damages were a result of a F-2 tornado.

Source: <http://www.crh.noaa.gov/pah/storm/1999jan21/jan17stm.php>



File: Tornado_Spring2009

Date: Exact unknown, Spring 2009

Description: The Tingley residence on Route 127 South of Jonesboro after the tornado.

Source: Karen from the Jonesboro Public Library

Winter Storms

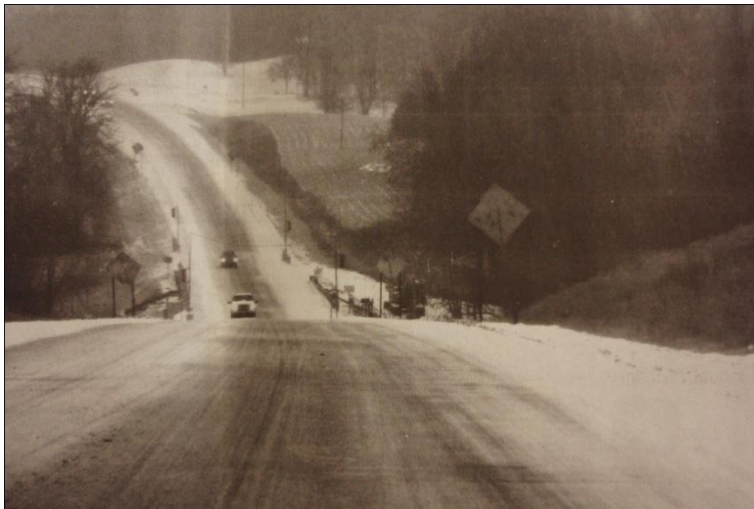


File: Winter_Jan_2009

Date: Late January 2009

Description: A heavy accumulation of ice and snow apparently caused the collapse of a building in downtown Anna Wednesday. The roof over the rear portion of Davis Pastry on South Main Street fell, along with a part of the outer wall. Police closed access to the alley between Main and South streets because of the debris from the collapse.

Source: *The Gazette-Democrat*, Volume 160, Number 5, 2009 Reppert Publications



File: Winter2_Jan_2009

Date: January 27, 2009

Description: Traffic was moving slowly along new U.S. Route 51 between Anna and Cobden Tuesday morning, Jan. 27, as a winter storm moved through the Union County area. The highway was covered with a heavy layer of sleet, which made travel treacherous.

Source: *The Gazette-Democrat*, Volume 160, Number 5, 2009 Reppert Publications



File: Winter3_Jan_2009

Date: Late January 2009

Description: Illinois Department of Transportation vehicles were common sights early this week as crews worked to keep highways clear during a major winter storm.

Source: *The Gazette-Democrat*, Volume 160, Number 5, 2009 Reppert Publications

Fire



File: Fire_Aug_1914

Date: August 14, 1914

Description: The aftermath of a devastating fire in Dongola, IL.

Source: *Pictures from the Past: Union County, IL*



File: Fire2_Aug_1914

Date: August 14, 1914

Description: The aftermath of a devastating fire in Dongola, IL.

Source: *Pictures from the Past: Union County, IL*



File: Fire_1967

Date: 1967

Description: Fire destroyed a large segment of downtown Anna in 1967. Lost to the blaze were the Moose Lodge, Elks Lodge, Anna Cleaners, The Grill and Gebhart's Auto Supply.

Source: *Pictures from the Past: Union County, IL*



File: Fire2_1967

Date: 1967

Description: Fire destroyed a large segment of downtown Anna in 1967. Lost to the blaze were the Moose Lodge, Elks Lodge, Anna Cleaners, The Grill and Gebhart's Auto Supply.

Source: *Pictures from the Past: Union County, IL*



File: Fire3_1967

Date: 1967

Description: Fire destroyed a large segment of downtown Anna in 1967. Lost to the blaze were the Moose Lodge, Elks Lodge, Anna Cleaners, The Grill and Gebhart's Auto Supply.

Source: *Pictures from the Past: Union County, IL*



File: Fire4_1967

Date: 1967

Description: Fire destroyed a large segment of downtown Anna in 1967. Lost to the blaze were the Moose Lodge, Elks Lodge, Anna Cleaners, The Grill and Gebhart's Auto Supply.

Source: *Pictures from the Past: Union County, IL*

Flood

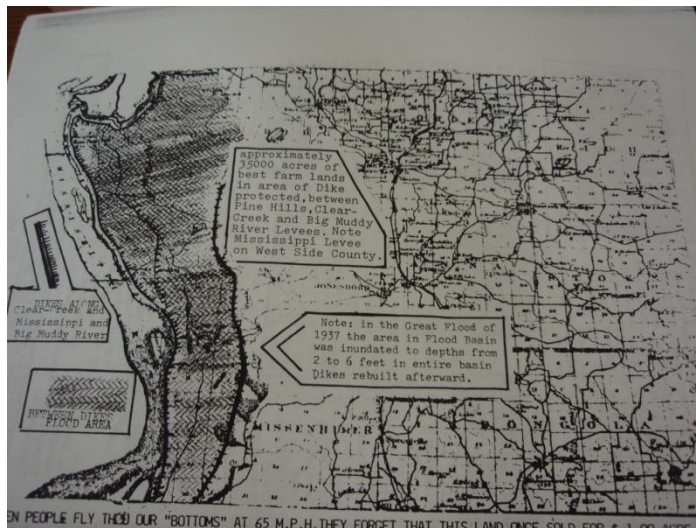


File: Flood_March_2008

Date: March 2008

Description: "Union County Animal Shelter floods during March flood."

Source: The Southern



File: Flood_1937

Date: January 1937

Description: Map showing the extent of the 1937 flood.

Source: Parks, George E. *History of Union County, Volume 2.*



File: Flood_1943

Date: 1943

Description: Wolf Lake during the 1943 Flood.

Source: *Pictures from the Past: Union County, IL*

**File:** Flood2_1943**Date:** 1943**Description:** A break in the Big Muddy River levee caused flooding in the bottomlands from south of Grand Tower to Gale.**Source:** *Pictures from the Past: Union County, IL***File:** Flood3_1943**Date:** 1943**Description:** Wolf Lake during the 1943 Flood.**Source:** *Pictures from the Past: Union County, IL***File:** Flood4_1943**Date:** 1943**Description:** Farmland covered in the flood of 1943.**Source:** *Pictures from the Past: Union County, IL***File:** Flood5_1943**Date:** 1943**Description:** Farmland covered in the flood of 1943.**Source:** *Pictures from the Past: Union County, IL*



File: Flood6_1943

Date: 1943

Description: Farmland covered in the flood of 1943.

Source: *Pictures from the Past: Union County, IL*

Appendix D - Historic Hazards: National Climatic Data Center U.S. Storm Event Database for Union County Illinois

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	8/15/1996	Drought	N/A	0	0	0	0	The drought severity index indicated extreme drought conditions over parts of southern Illinois the last week of August. Only 0.11 inches of rain fell at Paducah during the month. This was the second driest month since 1962 at Paducah, and it was the driest August on record. River levels dropped well below normal, but no serious navigation problems were reported.
Union	9/1/1998	Drought	N/A	0	0	0	0	September, 1998 was one of the driest Septembers on record in southern Illinois. Across the Ohio River at Paducah, Kentucky, where the monthly rainfall total was only 0.12 inch, it was the driest September on record. The dry weather was costly to farmers of certain crops, especially soybeans. The drought reduced yields for soybeans and late-planted corn by 25 to 30 percent in some counties. The drought, which was classified as "mild," began in early August. The lack of rainfall late in the summer was mitigated by one of the wettest springs on record.
Union	8/1/1999	Drought	N/A	0	0	0	0	After one of the wettest Junes on record, the rest of the summer was quite dry. By the end of August, parts of Southern Illinois were in a moderate drought, according to the Palmer Drought Index. There was a wide range in drought conditions. Places close to the Ohio River bordered on severe drought, while farther northwest from Mount Vernon to Carbondale, the drought was mild. A couple of times during August, thunderstorms produced heavy rain west and north of Carbondale but dissipated before reaching the Ohio River. The effect of the drought on crops was greatest for soybeans, which rely more heavily on summer rainfall. The corn crop fared relatively well because it matured in the late spring, when abundant rains fell. The dry weather raised the fire danger into the very high category at times. During one of the larger grass fires about 10 miles northeast of Carbondale, a fire truck was destroyed by fire. Drinking water supplies were threatened in the Marion area, mainly because Marion's water supply depends on a fairly small lake. As a precautionary measure, Marion began pumping water from a lake near Herrin, but water levels in that lake dropped significantly. On the Ohio River, low water levels made navigation more hazardous for barge traffic, and voluntary load limits were put in place downriver from Paducah, KY.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	9/1/1999	Drought	N/A	0	0	0	0	The moderate to severe summer drought took a considerable toll on crops across southern Illinois. The worst drought conditions were along the Ohio River, where Paducah, KY, received only 1.5 inches of rain in the three-month period from July to September. Carbondale received much more generous rainfall, with a three-month total of 5.5 inches. The soybean crop suffered the greatest effects from the drought, with yields in most areas only near 20 percent of normal. Corn yields were much closer to normal due to plentiful rains in June and early July, when the corn crop matures most rapidly. Small ponds and reservoirs became very low. The city of Marion, which relies on a small lake for its drinking water supply, was forced to siphon water from its neighboring city of Herrin. Low water levels in Union and Jackson Counties forced some cattle farmers to haul water to their herds. The fire danger reached extreme levels at times. The Illinois Department of Natural Resources issued a wildfire alert for southern Illinois due to the combination of drying grasses, brisk winds, and low humidity. Outdoor burning was banned in seven counties, including Alexander, Pope, Johnson, Jackson, Union, Pulaski, and Hardin. Local burning bans were posted in other counties. Among the many wildland fires that occurred, one of the largest was near West Frankfort, where 80 acres were scorched. River levels on the Ohio River became unsafe for navigation in places. Fully loaded barges could not safely navigate the river, so tonnage was reduced by 10 to 20 percent.
Union	10/1/1999	Drought	N/A	0	0	0	0	The moderate to severe summer-long drought conditions were greatly alleviated by heavy rain on October 8th and 9th. Rainfall totals were mainly between 2 and 4 inches during a 24-hour time frame. Even though the rain was too late for most crops, it replenished ponds used for watering cattle. Bans on open burning were lifted after the rain fell. No rain fell during the rest of the month, which renewed drought concerns by the end of October.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	11/1/1999	Drought	N/A	0	0	0	0	The unseasonably warm and dry fall allowed drought conditions to worsen. The Palmer Drought Index fell deeper into the moderate drought category during the month. Total rainfall for the month of November at Carbondale was about a quarter of an inch, which is about 3.5 inches below normal. Since the official growing season was over, crop damage was no longer a major concern. As a result of temperatures in the 70s, gusty winds, and low humidity, wildfire activity was above normal. Burning bans were imposed across much of southern Illinois, including the counties of Jackson, Union, Alexander, Pulaski, Johnson, Pope, Saline, and Hardin. A rash of grass and brush fires occurred early in the month, keeping area fire departments busy. A controlled trash fire near West Salem, in Edwards County, got out of hand and burned down a storage shed and all of its contents.
Union	12/1/1999	Drought	N/A	0	0	0	0	Moderate drought conditions continued to plague parts of southern Illinois into early winter. Heavy rainfall at mid-month brought significant relief. Before then, the dry weather caused unusually high wildfire activity. Campfires and other outdoor burning was banned in several counties, including Alexander, Hardin, Jackson, Johnson, Pope, Pulaski, and Union.
Union	8/1/2002	Drought	N/A	0	0	0	0	Moderate drought conditions developed over southern Illinois during August as a result of persistent dryness that began in June. At Carbondale, no measurable rainfall was reported during the entire month of July, and August rainfall was just over half an inch. This dry period came on the heels of a very wet first half of the year, when 24 to 30 inches fell from January through May. The main effect of the drought was on agriculture. Farmers anticipated substantial crop losses at harvest time. Heavy spring rains delayed planting of many crops until late May, which made them especially susceptible to the summer heat and drought.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	9/1/2002	Drought	N/A	0	0	0	53.0M	A prolonged summer drought gradually worsened, becoming severe by early September. Many parts of southern Illinois received little or no measurable rainfall in July. At Paducah, Kentucky, the three-month period from June through August of 2002 was the second driest such period on record. The main effect of the drought was on agriculture. Crop loss estimates totalled around 53 million dollars in southern Illinois. The corn crop, which was especially susceptible to the combined effects of heat and drought, took the biggest hit. About 33 million dollars in corn was lost in southern Illinois. Another 20 million dollars was lost in soybean production. Some trees and shrubs died in the drought, especially newly planted ones with shallow root systems. A few outdoor fires broke out, including a 20-acre blaze in Saline County, several miles west of Eldorado. The remnants of Tropical Storm Isidore provided much-needed heavy rainfall late in September. One to three inches of rain fell over most of southern Illinois, which greatly eased the drought.
Union	6/1/2005	Drought	N/A	0	0	0	0	Southern Illinois was classified in a moderate drought as June became the fourth consecutive month of below normal rainfall. Some locations received heavy rainfall in June from thunderstorms, but the storms were rather short-lived and infrequent. Farmers faced a variety of significant problems. Hay growth and production was halted, prompting concern about a hay shortage. Other crops, such as corn and soybeans, were slowed or stunted by the dry weather. Some yield reductions were anticipated, depending on July rainfall amounts. Levels of smaller rivers and creeks fell far below normal.
Union	7/1/2005	Drought	N/A	0	0	0	0	Moderate drought conditions persisted over southern Illinois until the remnants of Hurricane Dennis arrived, producing from 2 to 5 inches of rain. Although the rain was beneficial, it came too late for some crops. All of southern Illinois except for Alexander County was designated as an agricultural disaster area by the U.S. Department of Agriculture. A local newspaper in the lower Wabash Valley reported that the local corn and soybean crop would suffer a 50 percent yield reduction due to the drought. Final crop figures will not be available until the fall harvest.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	8/1/2005	Drought	N/A	0	0	0	0	Drought conditions eased considerably during early and mid August as thunderstorm activity increased to typical levels for mid-summer. Timely rainfall offset the potentially devastating agricultural impacts of this drought. River levels on the Ohio and Mississippi Rivers continued to drop through the middle of the month. At Cairo, the Ohio River stage fell as low as 7.2 feet. The effects on Ohio River traffic were comparable to those observed in the 1997 and 1988 droughts. Barges ran aground, forcing the Coast Guard to close a seven-mile stretch of the Ohio River from Mound City to Olmsted for almost a week. Several hundred barges were reportedly waiting to pass through the bottleneck. The U.S. Army Corps of Engineers conducted emergency dredging operations to reopen the river. A casino riverboat in Metropolis was closed due to complications from the low water, only eight months after having been closed by high water. Along the Mississippi River, a power generation plant in Grand Tower (Jackson County) closed for a couple weeks because water levels were too low to generate electricity.
Extreme South Illinois	11/15/1995	Early Snow	N/A	0	0	0	0	The extreme southern tip of Illinois around Cairo was affected by a very early season snowfall. Up to an inch of snow was measured in Cairo. Most of the snow was across the Mississippi River in Missouri, where up to three inches fell near Cape Girardeau.
Union	7/2/1997	Excessive Heat	N/A	1	0	0	0	Temperatures rose well into the 90s, and high humidity raised the heat index to between 105 and 110 degrees. Near Carmi, a 32-year-old male construction worker died as a result of the heat. The man's body temperature was 106 degrees. The coroner ruled that the man, who alternated between digging and operating a backhoe, was primarily a victim of the heat and humidity. The heat index at Evansville at the time of death was 105 degrees. M32EQ
Union	7/25/1997	Excessive Heat	N/A	0	12	0	0	High temperatures rose well into the 90s, with even a few 100 degree readings. High humidity pushed heat index values to between 105 and 115 degrees. A heat advisory was issued for the potentially hazardous conditions. Area hospitals reported at least a half dozen cases of dehydration or other heat-related illnesses. An increase in the number of disabled vehicles was reported, as well.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	6/22/1998	Excessive Heat	N/A	1	0	0	0	Temperatures exceeded 90 degrees for at least 7 consecutive days. Oppressive humidity produced heat indices as high as 110 degrees. The prolonged heat and humidity resulted in the death of an elderly man in Johnston City, near Marion. The coroner measured the temperature in his apartment, where his body was found, at 110 degrees. M83PH
Union	7/18/1999	Excessive Heat	N/A	4	0	0	0	Prolonged heat and humidity during the latter half of July took its toll on the unprepared. Four fatalities were blamed on the heat, including two in Wayne County. Near Fairfield, a 78-year-old man died after driving his riding lawn mower to a trucking firm to gather landscape rocks. The man was found near a pile of rocks he had been gathering in 95-degree heat. Near Mount Erie, an 85-year-old man was found dead in his home. The windows were closed, and there was no air conditioning. Elsewhere in southern Illinois, a 53-year-old migrant worker died while laboring in a field near Shawneetown in Gallatin County. The man died at an Evansville hospital after suffering a heat stroke. The fourth death occurred in the Ohio River city of Metropolis, where an 82-year-old woman was found dead in her bathroom. This was the first time in his tenure as Massac County coroner that the cause of death was ruled as heat exhaustion. The woman did not use a fan in the house, and the indoor temperature was measured at 98 degrees. Daily highs were near 100 degrees on the 29th and 30th, with afternoon heat indices from 110 to 115 degrees. At Paducah, Kentucky, across the Ohio River from Metropolis, this was the fifth warmest July on record. M53OU, F82PH, M78OU, M85PH
Union	7/7/2001	Excessive Heat	N/A	0	0	0	0	Daytime high temperatures in the mid to upper 90's, combined with dew points in the mid 70's, resulted in heat indices from 105 to 112 degrees. Nighttime heat indices only fell to around 80.
Union	8/3/2002	Excessive Heat	N/A	0	8	0	0	High temperatures reached 100 degrees for three consecutive days in parts of southern Illinois. At Carbondale, the high was 100 degrees on the 3rd and 4th, and 101 on the 5th. Humidity contributed to the problem, with afternoon heat indices peaking near 105 degrees. Area hospitals reported surprisingly few cases of heat exhaustion, and no heat-related fatalities occurred. Hospitals reported seeing many people with pre-existing health conditions that were aggravated by the heat and humidity.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	7/21/2005	Excessive Heat	N/A	0	62	0	0	Several days of excessive heat and humidity caused a significant increase in heat-related illnesses. Hospitals reported that a majority of those treated were outdoor workers. The heat index peaked around 110 degrees each afternoon, and dropped to only around 80 degrees at night. True air temperatures reached the mid 90's, with overnight lows in the mid 70's. At Carbondale, the heat index topped out at 112 degrees on the 21st and the 22nd, 105 on the 23rd, 115 on the 24th, 106 on the 25th, and 109 on the 26th. These heat indices were representative of the rest of southern Illinois. The heat wave was the result of an expansive surface high pressure system extending from the Gulf of Mexico to the Great Lakes. A light southerly wind flow, combined with moist ground from the remnants of Hurricane Dennis earlier in the month, allowed dew points to hover around 80 degrees.
Union	8/19/2005	Excessive Heat	N/A	0	0	0	0	The heat index exceeded 105 degrees on two consecutive afternoons across most of southern Illinois. At Carbondale, the peak heat index was 111 degrees on the 19th and 106 on the 20th.
Union	2/2/1996	Extreme Cold	N/A	0	0	0	0	The most severe cold snap of the 1995-96 winter season caused many problems with burst pipes and overworked furnaces. Calls to one heating system specialist were up 30 to 40 percent. Central Illinois Public Service Co. broke its winter electric peak record. Residents of Pinckneyville were asked to conserve natural gas due to dwindling supplies. The shortage was partly the result of gas wells that were freezing up. The overflow valve on the water tower in DeSoto froze up, causing thousands of gallons of water to escape from the top. Many cities dealt with water main breaks as the cold weather put stress on the pipes. Wind chills were occasionally as low as minus 40 degrees. Actual daytime highs on the third were in the single digits, with overnight lows from minus 6 to minus 11. The extreme cold significantly damaged the peach crop, which is vulnerable to severe winter cold snaps.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	12/12/2000	Extreme Cold	N/A	0	0	0	0	An invasion of arctic air occurred on December 12. The arctic air became permanently entrenched over the region for the remainder of the month, resulting in the coldest December on record at Paducah, KY. The average monthly temperature of 25.9 degrees was 11.4 below normal. On the coldest day of the month, the 17th, the high was 17 and the low was 6. Unusually high energy prices, combined with the record cold, caused homeless shelters to fill to capacity. The usual problems associated with frigid temperatures, such as frozen pipes and water main breaks, were common during the latter half of the month. At Brookport, across the river from Paducah, the pipe extending down from the water tower froze, causing it to burst. As a result, Brookport temporarily had no water supply until emergency wells were dug. Heavy ice on the Mississippi River prompted the Coast Guard to restrict barge traffic from Cairo, IL northward.
Union	1/1/2001	Extreme Cold	N/A	0	0	0	0	The prolonged arctic freeze that began during the second week of December finally ended by January 4. During the first few days of the new year, temperatures averaged 15 to 25 degrees below normal. Overnight lows were around zero. As a result, ice continued to be a problem on the Mississippi River. The combination of ice and low river levels made navigation for barges very hazardous. About 10 miles north of Cape Girardeau, MO, 15 barges loaded with coal went aground.
Union	1/23/2003	Extreme Cold/wind Chill	N/A	0	0	0	0	Wind chills fell to between minus 10 and minus 15 across southern Illinois during the morning. This cold snap was just one of many cases of harsh winter weather during January. At Paducah, KY, preliminary figures indicate January of 2003 was the eighth coldest January on record, and the coldest since 1985. After the relatively mild winters of the past several years, the bitter mid-winter cold came as a shock to many. Temperatures fell below zero at many locations for the first time in several years. At Carbondale, the low temperature on January 24 was minus 6. The prolonged cold weather resulted in numerous frozen pipes, as well as problems with heating systems. A number of house fires were blamed on overtaxed heating systems. At least one ice rescue was conducted when children fell through thin ice on a pond in Fort Massac State Park in Metropolis.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	12/23/2004	Extreme Cold/wind Chill	N/A	1	0	0	0	Bitterly cold temperatures arrived in the wake of a paralyzing snowstorm. In Murphysboro, an 84-year-old woman died from hypothermia after venturing outdoors to locate her pet dog on the evening of December 22. The woman apparently became disoriented and collapsed from hypothermia. Although she was located about an hour after venturing outdoors from the assisted living facility, she was pronounced dead shortly after midnight on December 23. The low temperature on Christmas morning was 11 degrees below zero at Carbondale. Co-operative observers reported Christmas morning lows of 6 below at Grayville and 2 below zero at Cairo. Winds were light during the coldest weather, which reduced the wind chill hazard somewhat. F85OU
Union	1/10/1997	Extreme Windchill	N/A	1	0	0	0	Arctic air blew into the region in the wake of a departing snowstorm. A wind chill advisory was issued for wind chills as low as minus 30. A woman in her 60s froze to death after she slipped and fell outside her home near Orient in Franklin County. The city of Murphysboro recommended letting faucets drip to prevent pipes from freezing. F65OU
Anna	6/29/1998	Flash Flood	N/A	0	0	0	0	Thunderstorms that caused major flash flooding to the northwest, especially Franklin and Perry Counties, moved southeast across parts of southeast Illinois. There were reports of flooded roads and near bankful conditions.
Union	1/21/1999	Flash Flood	N/A	0	0	100K	0	In Jackson County, sheriff's deputies used a johnboat to help evacuate a family whose house became surrounded by water. In Williamson County, several roads were closed by high water, including Old Route 13 near Route 148. About a dozen cars were stranded in flood water in the Marion area and had to be pulled out. Many of them ignored barricades set up to divert traffic from flooded areas.
Union	1/22/1999	Flash Flood	N/A	0	0	0	0	More heavy rain following the thunderstorms the previous evening caused a renewal of flooding problems. In Alexander County, Cairo High School was closed due to flooding problems.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	12/17/2001	Flash Flood	N/A	0	0	0	0	Heavy rain falling on saturated ground caused water levels to rise quickly. After the initial rapid rises, a prolonged period of flooding set in as light to moderate rain continued to fall. In Williamson County, water was 3 feet deep over the Saline River bridge on a county road, and roads were washed out. In Hardin County, some bridges were washed out. Illinois Route 146 was closed near Anna, and Route 145 was barricaded north of Route 146 in Pope County. Pulaski County reported 15 to 20 road closures. Water entered at least two businesses in Vienna. A car dealership and a city park in Vienna were flooded by the Little Cache Creek. In Johnson County, a total of 20 road closures were reported, and the community of Flatwoods was completely cut off for a short time. Near Elba in Gallatin County, several families were forced from their homes due to backwater flooding. Water entered an elementary school in Metropolis. Water also entered a warehouse in Metropolis used to store Christmas toys for needy local children. Several hundred dollars worth of toys were damaged. Numerous roads were closed throughout southern Illinois.
Anna	1/31/2002	Flash Flood	N/A	1	0	0	0	A 3-year-old child was killed when her grandmother attempted to carry her across a flooded creek on foot. The grandmother was unable to cross the creek in her vehicle, so she attempted to cross on foot. The grandmother lost her footing in the creek, and the child was swept away and drowned. The flooding was caused by a large area of moderate to heavy rain falling on ground that was still moist from flooding rains a week earlier. An observer in Anna measured about 1.7 inches of rain. F3OU

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	5/12/2002	Flash Flood	N/A	0	0	8K	0	In Union County, flash flooding struck the small community of Mill Creek, forcing some residents out of their homes. An elderly woman was rescued by boat from her flooded home, and Route 127 was closed. Some residents of the Reynoldsville area of Union County were only able to boat to and from their homes. In Alexander County, flash flooding damaged about 12 homes, mainly in the Tamms and Elco areas. Twelve to 14 bridges and about 40 roads were washed out or damaged. In other counties, many secondary roads were closed across southern Illinois, including 8 in Jackson County. Water was over Route 4 near Campbell Hill in northwest Jackson County. In Edwards County, a 24-hour rainfall amount of 4.95 inches was reported at Browns, and 4.5 inches was reported at West Salem. High water caused one stranded motorist to be rescued near West Salem. Floodwaters from Little Bonpas Creek closed at least one road and flooded others. There were numerous roads with water over them in Wayne and Edwards Counties, including Highway 15 about 2 miles west of Fairfield and Route 45 between Geff and Cisne. In Jefferson County, water was over Two Mile Creek Road and Brownsville Road.
Union	5/17/2002	Flash Flood	N/A	0	0	0	0	Water was over several roads in each county. In Union County, Highway 127 in Jonesboro and Highway 146 just west of Jonesboro were flooded.
Union	4/29/2003	Flash Flood	N/A	0	0	0	0	A complex of severe thunderstorms produced large hail and flash flooding over Union County. The hail ranged from quarter to golf-ball size. At least 60 reports of hail damage were reported to insurance companies. Flash flooding of streets was videotaped by news media. A thunderstorm with torrential rain persisted for about an hour between Anna and Cobden.
Union	5/6/2003	Flash Flood	N/A	0	0	0	0	Thunderstorms with very heavy rain dumped estimated rainfall amounts of 2 to 4 inches in a few hours across parts of southern Illinois. Water was reported over many roads. Parts of U.S. Highway 51 were flooded between Du Quoin and Tamaroa in Perry County. In Hardin County, many county roads were closed after being flooded or washed out. A motorist was stranded in high water along a street in Anna in Union County. A weather observer in Anna measured nearly 7 inches of rain during the week ending May 7.
Union	11/15/2005	Flash Flood	N/A	0	0	0	0	Water was over Illinois Route 146 near Ware and over Lick Creek Road northeast of Anna. An unofficial rainfall total of 6.5 inches was reported on the southeast side of Cobden.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	11/15/2005	Flash Flood	N/A	0	0	0	0	Major flooding on Morgan School Road prompted the evacuation of an elderly man. The man was evacuated by boat after floodwaters from Clear Creek surrounded his home. Several county roads were under water. During this new round of thunderstorms, an additional 2.25 inches of rain was reported on the southeast side of Cobden, bringing the unofficial total to 8.75 inches. A co-operative observer in Anna recorded 6.24 inches for November 15.
Dongola	3/9/2006	Flash Flood	N/A	0	0	30K	0	U.S. Highway 51 was closed in several locations due to water over the road. Water rose over other low-lying roads. A number of washouts occurred on roads throughout the county. Creeks were swollen. Two observers in Anna measured between 4 and 5 inches of rain for the calendar day.
Union	8/27/2006	Flash Flood	N/A	0	0	0	0	Water was over several roads. More than three inches of rain was measured in Anna for the calendar day. Unofficial reports indicated over 4 inches of rain in Jonesboro and 2 inches in Cobden.
Union	5/1/1996	Flood	N/A	0	0	50K	0	The Mississippi River was above flood stage all month at Thebes. It crested there at 40.5 feet on May 17, which is 7.5 feet over flood stage. The main effects were several closed roads and many acres of flooded crops. Flooding was widespread in the low-lying areas around Cache and Miller City. Very few homes were threatened by the rising water. Although crop damage estimates were not yet available, property damage was minimal.
Union	6/1/1996	Flood	N/A	0	0	0	0	The Mississippi River remained above flood stage from late April well into June. At Thebes, the river crested at 39.5 feet on June 4, and fell below flood stage on June 20. Flood stage at Thebes is 33 feet. A few homes that were evacuated in May remained vacant. Agricultural bottomland and roads closest to the river remained flooded.
Union	2/26/1997	Flood	N/A	0	0	0	0	Heavy rainfall during the last half of February across the upper Plains sent the Mississippi River rising over flood stage by month's end. At Thebes, the river rose above the 33 foot flood stage on the 26th. Only minor bottomland flooding occurred through the end of the month.
Union	3/1/1997	Flood	N/A	0	0	20K	0	The Mississippi River remained above flood stage from late February well into March at Thebes. The river crested about 6 feet above flood stage at Thebes on March 3, then a couple feet over flood stage on the 17th. Generally minor to moderate flooding of the river caused agricultural fields to flood. Water lapped against some of the levees,

								including the one near Ware. A half mile stretch of Old Cape Road was closed water across it.
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	4/4/1998	Flood	N/A	0	0	0	0	The Mississippi River crested at 38.3 feet at Thebes on the 20th. Flood stage there is 33 feet. Moderate flooding of lowland agricultural areas occurred, and some roads were inundated. This forced some school busses to be rerouted around flooded areas.
Union	5/1/1998	Flood	N/A	0	0	0	0	Minor flooding of the Mississippi River continued into early May. The river crested two feet above flood stage at Thebes on the 3rd of May. Flooding was generally confined to low-lying agricultural areas and access roads.
Union	6/21/1998	Flood	N/A	0	0	0	0	The Mississippi River crested at 35.4 feet at Thebes on June 26. Flood stage there is 33 feet. This resulted in minor flooding of agricultural bottomland.
Union	4/20/1999	Flood	N/A	0	0	0	0	Heavy rain during the first half of April caused the Mississippi River to rise above flood stage. Rainfall amounts during the first six days of the month ranged from one and one half to over 4 inches. At Thebes, where flood stage is 33 feet, the river crested at 34.6 feet on the 23rd. This caused minor flooding of mainly agricultural areas.
Union	5/1/1999	Flood	N/A	0	0	12K	0	The Mississippi River was above flood stage at the Thebes gage for most of the month. The flooding was minor to moderate, confined to unprotected bottomlands and adjacent access roads. The first crest of 37.0 feet occurred on the 10th, with a second crest of 33.7 feet on the 28th. Flood stage is 33 feet. Between the two crests, the river was below flood stage from the 14th to the 22nd. Another effect of the high river levels was to raise tributary creeks and rivers above their banks, including the Big Muddy River.
Union	6/1/1999	Flood	N/A	0	0	0	0	After being over flood stage for much of May, the Mississippi River remained slightly above flood stage through early June. The river was no more than a few inches above flood stage in early June, which caused only minor flooding of some agricultural bottomland.
Union	2/28/2001	Flood	N/A	0	0	0	0	The Mississippi River rose to flood stage at Thebes on the last day of the month. Since the river was barely above flood stage, no significant flooding occurred.

Union	3/1/2001	Flood	N/A	0	0	0	0	The Mississippi River remained just above flood stage from late February. At Thebes, which is several miles downriver from Cape Girardeau, MO, the river crested at 33.92 feet. Flood stage is 33 feet at Thebes. This resulted in minor flooding of low-lying bottomlands. The crest occurred about 8 A.M. on March 2, and the river was back below flood stage on March 3.
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	5/21/2001	Flood	N/A	0	0	0	0	Even though rainfall was generally below normal across southern Illinois, the Mississippi River rose above flood stage at Thebes due to heavy rains in the Missouri River basin and upper Mississippi Valley. The river gage at Thebes crested about one foot above the 33-foot flood stage on May 24, which resulted in minor flooding of agricultural bottomland. Most planting was completed before this flooding event, which prompted some bottomland farmers to take action to save their crops. Along the Mississippi River just above Cairo, a farmer used heavy equipment to build more than a half mile of earthen levees to protect 100 acres of threatened cropland.
Union	6/8/2001	Flood	N/A	0	0	0	0	Heavy rains across the Missouri River basin and parts of the Mississippi River basin caused rises on the Mississippi River. Thebes crested about 5 feet above flood stage on the 12th. The river was slow to fall, finally going below flood stage at Thebes on the 17th. This was short-lived, as another round of heavy rains in the above-mentioned basins caused another crest on the 27th. Thebes crested about a foot below flood stage this time. The first crest on June 12 resulted in moderate flooding that was primarily agricultural.
Union	12/17/2001	Flood	N/A	0	0	8K	0	Numerous roads were flooded in most southern Illinois counties, including a few primary routes. In Hamilton County, Route 142 was closed south of Mcleansboro. In Alexander County, a residence near Tamms was evacuated. Rainfall amounts for December 16-17 were commonly 3 to 5 inches in the flooded areas. In Union County, 4.35 inches was measured at Anna. Flooding blocked railroad tracks in Union County. An Amtrak train was forced to make an unplanned stop at the Anna station, and all 75 passengers found alternate means of travel.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	5/8/2002	Flood	N/A	0	0	1.5M	0	Major flooding of the Mississippi River occurred. The river rose above flood stage at Thebes on May 8, then reached its crest of 44.3 feet on May 18. Flood stage at Thebes is 33 feet. This resulted in extensive flooding of farmland and threats to some developments. Backwater from the Mississippi threatened dozens of homes in the Horseshoe Lake area, including the Miller City and Olive Branch communities. These communities are between Cairo and East Cape Girardeau. As was the case in the floods of 1993 and 1995, emergency measures were taken to reinforce and build up levees around Olive Branch and Miller City. The levees held up, but structures not protected by levees were flooded. About 30 families evacuated due to flooding of their residences, mainly in the Miller City and McClure areas. At Thebes, the town's riverfront park was flooded, and a house and a church were flooded. Elsewhere, from Jackson County to Cairo, secondary roads near the river were closed, and parks and farmland were underwater.
Union	5/13/2003	Flood	N/A	0	0	0	0	The Mississippi River rose above flood stage in response to frequent severe thunderstorm activity in early May. The flooding was minor, with some low-lying agricultural land affected. Since springtime farming operations had begun, the effect of this flooding was relatively significant compared to winter season flooding. The river crested about one foot above flood stage. At Thebes, where flood stage is 33 feet, the crest was 33.6 feet on May 14.
Union	5/31/2004	Flood	N/A	0	0	0	0	Minor flooding of the Mississippi River occurred at the end of the month. At Thebes, the river crested at 33.45 feet on May 31, about one-half foot above flood stage. This resulted in minor flooding of low-lying woods and fields in the bottomlands.
Union	6/1/2004	Flood	N/A	0	0	0	0	Minor flooding of the Mississippi River continued from late May into early June. The river briefly dropped below flood stage at Thebes from June 2 to June 4. The river crested at Thebes on June 6 at 33.67 feet, less than one foot above flood stage. This resulted in minor flooding of low-lying fields and bottomlands near the river.
Union	1/7/2005	Flood	N/A	0	0	0	0	Minor flooding of the Mississippi River occurred. Residents of a mobile home park in Thebes moved campers and trailers about two blocks further away from the water. At Thebes, where flood stage is 33 feet, the river crested at 35.63 feet on the 16th. This resulted in flooding of bottomland and surrounding low-lying areas.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	9/23/2006	Flood	N/A	0	0	0	0	Water was reported over Lick Creek Road northeast of Anna and Morgan School Road west of Jonesboro. The flooding was the result of very heavy rainfall on Sept. 22 and 23. The two-day measured rainfall total was 4.89 inches at Anna and unofficially 6 inches in Cobden.
Union	12/9/1997	Fog	N/A	0	0	0	0	Widespread dense fog caused hazardous travel conditions. Visibility was generally a quarter mile or less over the area.
Union	12/18/1997	Fog	N/A	0	0	0	0	Patchy dense fog reduced visibility to near zero in some spots. With temperatures in the mid 20s, a layer of frost formed, even on some roads. This resulted in slick spots for early morning commuters.
Union	1/6/1998	Fog	N/A	0	0	0	0	Dense fog reduced visibility to a quarter mile or less across much of the area.
Union	1/27/1998	Fog	N/A	0	0	0	0	Widespread dense fog developed over far southern Illinois during the early morning hours. The most persistent dense fog occurred in the Marion/Carbondale area, where visibility was locally near zero for several hours. The dense fog hindered early morning commuters.
Union	1/30/1998	Fog	N/A	0	0	0	0	Widespread dense fog caused travel difficulties during the early morning hours. Illinois State Police reported visibility as low as two car lengths near Metropolis in Massac County.
Union	10/15/2000	Fog	N/A	0	0	0	0	Widespread dense fog blanketed all of southern Illinois from late evening on the 15th until the mid morning hours on the 16th. State police reported a rollover vehicle accident in the Mount Vernon area was due to the fog.
Union	3/31/2001	Fog	N/A	0	0	0	0	Widespread dense fog formed around midnight. During the early morning hours, visibility was below a quarter mile. One fatal accident was attributed to the fog. An elderly man driving east on Illinois 146 in Hardin County failed to stop where the road ends at Illinois Route 1. His vehicle struck a stone wall. The accident occurred at 7:15 A.M. The fog lifted between 8 and 9 A.M.
Union	1/17/1998	Freezing Drizzle	N/A	0	0	0	0	Light freezing drizzle caused icing of bridges and overpasses. Several accidents occurred on the Interstate 57 bridge over the Mississippi River. The U.S. 62 bridge over the Ohio River also became icy.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	12/21/1998	Freezing Rain	N/A	0	0	0	0	Rain changed to freezing rain and sleet late in the afternoon as a sharp cold front moved across the region. Temperatures plummeted from the upper 50s during the morning into the upper 20s by early nightfall. The wintry precipitation lasted for only a few hours, but was sufficient to cause numerous accidents. Most involved vehicles spinning out of control and sliding into ditches, but one accident was fatal. In Williamson County, a vehicle left the road and flipped over, killing the driver.
Union	12/15/2000	Freezing Rain	N/A	0	0	0	0	Freezing rain spread across most of southern Illinois during the late morning hours. Most of the icing was north and west of the counties bordering the Ohio River. The thin layer of ice, less than a quarter inch thick, caused some hazardous travel conditions. By late afternoon, the precipitation became too patchy and light to be a significant hazard.
Union	1/26/2001	Freezing Rain	N/A	0	0	0	0	Light freezing rain overspread southern Illinois just before the early morning commute time. The precipitation, which amounted to less than a tenth of an inch, lasted a few hours. Along and north of Interstate 64, there was more sleet than ice. Vehicle wrecks were most numerous from the Marion and Carbondale area north. State police reported several jack-knifed semis on Interstate 57, mainly from Marion to Benton.
Union	9/24/1995	Frost	N/A	0	0	0	0	An early frost caused some minor damage to crops and gardens. Since most corn and soybeans were harvested, and because shelter-level temperatures stayed above freezing in some areas, financial losses were generally not severe.
Union	4/18/1997	Frost	N/A	0	0	0	0	An unseasonably cold April caused problems for growers, especially fruit growers. The peach crop was especially vulnerable because above normal temperatures in March caused peach trees to blossom early. Lows on April 18 were in the upper 20s in some of the colder valleys. A fruit grower in Union County estimated nearly half of his peach crop was destroyed by cold temperatures.
Union	4/9/2000	Frost	N/A	0	0	0	0	A freeze caused some damage to fruit tree blossoms, mainly in low-lying areas. The peach blossoms were most heavily impacted. Estimates of peach losses at one orchard in Massac County ranged up to 50 percent. Warmer than normal temperatures in January and February caused peach trees to blossom too early, as early as the first part of March.

Union	10/9/2000	Frost	N/A	0	0	0	0	A widespread killing frost and freeze affected southern Illinois, bringing an end to the growing season. Low temperatures were in the middle 20s.
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	4/18/2001	Frost	N/A	0	0	0	0	An unusually late frost damaged unprotected crops and gardens. The low temperature at Carbondale was 27 degrees, and Mcleansboro in Hamilton County got down to 24 degrees. At an orchard 10 miles northeast of Metropolis, about half the peach and nectarine crop was killed.
Union	10/3/2003	Frost/freeze	N/A	0	0	0	0	Cold Canadian high pressure pushed the coldest air up through this point in the fall season into southern Illinois. Clear skies and calm winds allowed frost to form, except in the southern tip of the state from Cairo to Metropolis. This was unusually early in the season for the first frost. The low at Carbondale was 32 degrees.
Union	5/4/2005	Frost/freeze	N/A	0	0	0	0	An unusually late season frost affected most of southern Illinois except for the three southernmost counties. Temperatures fell into the mid 30s. Many unofficial readings from 34 to 36 degrees were recorded. This was the last of four consecutive frosty mornings. Lows each morning from May 1st to the 4th were about the same, mostly in the middle 30's. The combination of the cold weather and much lower than normal rainfall slowed the development of some early-planted corn and soybeans.
Union	10/28/2005	Frost/freeze	N/A	0	0	0	0	Widespread frost was observed across southern Illinois. Low temperatures were around 30 degrees at most locations.
Anna	6/14/1998	Funnel Cloud	N/A	0	0	0	0	State police reported a funnel cloud near the intersection of U.S. 51 and Illinois 146.
Ware	2/5/2008	Funnel Cloud	N/A	0	0	OK	OK	A deepening low pressure system moved northeast from Arkansas along a warm front that extended across southeast Missouri and southern Illinois. Surface dew points were in the upper 50's to lower 60's along and southeast of the warm front. A strong upper level trough over the western Plains produced a strong southwest flow of 60 to 80 knots at 500 mb. Winds at 850 mb were south to southwest around 40 knots.
Union	4/22/1963	Hail	0.75 in.	0	0	0	0	None Reported
Union	7/31/1967	Hail	2.75 in.	0	0	0	0	None Reported

Union	6/22/1969	Hail	1.25 in.	0	0	0	0	None Reported
Union	8/9/1969	Hail	1.75 in.	0	0	0	0	None Reported
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	4/13/1972	Hail	0.75 in.	0	0	0	0	None Reported
Union	6/28/1972	Hail	0.75 in.	0	0	0	0	None Reported
Union	7/5/1975	Hail	0.75 in.	0	0	0	0	None Reported
Union	9/25/1977	Hail	2.00 in.	0	0	0	0	None Reported
Union	4/3/1984	Hail	0.75 in.	0	0	0	0	None Reported
Union	5/14/1986	Hail	0.75 in.	0	0	0	0	None Reported
Union	4/3/1989	Hail	1.75 in.	0	0	0	0	None Reported
Union	4/23/1989	Hail	0.75 in.	0	0	0	0	None Reported
Union	4/9/1991	Hail	0.75 in.	0	0	0	0	None Reported
Union	4/9/1991	Hail	0.75 in.	0	0	0	0	None Reported
Reynoldsville	9/2/1993	Hail	0.75 in.	0	0	0	1K	
Carbondale	6/28/1994	Hail	1.00 in.	0	0	0	0	One-inch hail fell at Giant City State Park south of Carbondale.
Jonesboro	5/13/1995	Hail	1.00 in.	0	0	0	0	
Jonesboro	5/16/1995	Hail	0.75 in.	0	0	0	0	
Ware	5/16/1995	Hail	0.75 in.	0	0	0	0	

Jonesboro	5/17/1995	Hail	1.00 in.	0	20	0	0	About ten damage claims were filed with insurance companies as a result of the hailstorm. Enough hail fell to clog storm drains and turn the ground white. Undetermined damage was done to apple orchards.
Cobden	6/13/1997	Hail	0.88 in.	0	0	0	0	Nickel size hail was also reported near Licking Creek.
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Jonesboro	1/3/2000	Hail	0.88 in.	0	0	0	0	A trained spotter reported nickel-size hail.
Cobden	5/23/2000	Hail	1.75 in.	0	0	50K	0	Local newspapers showed photos of the hailstones, some of which were nearly the size of golf balls. Strong winds up to 50 MPH accompanied the storm. A large tree was down across a street in Anna, and a large limb was down in Jonesboro.
Jonesboro	5/23/2000	Hail	1.75 in.	0	0	0	0	This was the second of two severe thunderstorms that passed southeast across Union County in less than two hours. The main feature of both storms was golf ball size hail.
Dongola	8/18/2001	Hail	0.75 in.	0	0	0	0	None Reported
Alto Pass	5/25/2002	Hail	0.88 in.	0	0	0	0	Thunderstorms produced large hail at several locations in southern Illinois. The most intense hailstorm occurred at Marion, where hailstones were up to the size of golf balls. The hail dented numerous vehicles and broke mirrors and tail lights. Leaves were stripped off trees, and some limbs were down. The hail damaged vinyl siding, broke house windows, and caused some roof damage. Other hail reports in southern Illinois were quarter-size or smaller. The hail lasted long enough to cover the ground at Alto Pass. The only report of strong winds was near Mount Vernon, where large limbs were blown down on Route 148 south of town.
Jonesboro	5/25/2002	Hail	1.00 in.	0	0	0	0	Thunderstorms produced large hail at several locations in southern Illinois. The most intense hailstorm occurred at Marion, where hailstones were up to the size of golf balls. The hail dented numerous vehicles and broke mirrors and tail lights. Leaves were stripped off trees, and some limbs were down. The hail damaged vinyl siding, broke house windows, and caused some roof damage. Other hail reports in southern Illinois were quarter-size or smaller. The hail lasted long enough to cover the ground at Alto Pass. The only report of strong winds was near Mount Vernon, where large limbs were blown down on Route 148 south of town.

Anna	4/4/2003	Hail	0.75 in.	0	0	0	0	A thunderstorm tracked east across southern Illinois, beginning near Anna and exiting into Kentucky from Hardin County. The storm produced sporadic reports of hail up to dime size.
Cobden	4/29/2003	Hail	1.00 in.	0	0	0	0	A complex of severe thunderstorms produced large hail and flash flooding over Union County. The hail ranged from quarter to golf-ball size. At least 60 reports of hail damage were reported to insurance companies. Flash flooding of streets was videotaped by news media. A thunderstorm with torrential rain persisted for about an hour between
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Cobden	4/29/2003	Hail	1.25 in.	0	0	0	0	A complex of severe thunderstorms produced large hail and flash flooding over Union County. The hail ranged from quarter to golf-ball size. At least 60 reports of hail damage were reported to insurance companies. Flash flooding of streets was videotaped by news media. A thunderstorm with torrential rain persisted for about an hour between Anna and Cobden.
Anna	4/29/2003	Hail	1.25 in.	0	0	0	0	A complex of severe thunderstorms produced large hail and flash flooding over Union County. The hail ranged from quarter to golf-ball size. At least 60 reports of hail damage were reported to insurance companies. Flash flooding of streets was videotaped by news media. A thunderstorm with torrential rain persisted for about an hour between Anna and Cobden.
Alto Pass	3/20/2004	Hail	0.88 in.	0	0	0	0	A line of thunderstorms formed across southern Illinois, near a line from Carbondale to Harrisburg, and then moved south. A couple of the storms in this line produced large hail up to the size of nickels.
Cobden	3/20/2004	Hail	1.00 in.	0	0	0	0	A severe thunderstorm moved across the Marion area of Williamson County, producing dime size hail and some minor wind damage. Many shingles were blown off the roof of a residence in Marion. Another severe thunderstorm tracked east across Union and Johnson Counties, producing a couple reports of dime to quarter size hail.
Anna	3/30/2005	Hail	0.75 in.	0	0	0	0	Severe thunderstorms moved northeast across the southern tip of Illinois, passing south and east of the Marion/Carbondale area. The storms produced numerous reports of large hail.
Mt Pleasant	3/30/2005	Hail	1.00 in.	0	0	0	0	Quarter-size hail fell near the Johnson County line. Severe thunderstorms moved northeast across the southern tip of Illinois, passing south and east of the Marion/Carbondale area. The storms produced numerous reports of large hail.
Anna	3/11/2006	Hail	0.75 in.	0	0	0	0	None Reported

Jonesboro	4/2/2006	Hail	1.75 in.	0	0	0	0	None Reported
Jonesboro	4/2/2006	Hail	1.75 in.	0	0	0	0	Golf ball size hail fell along Highway 127 two miles north of Jonesboro. Quarter size hail fell in Cobden.
Ware	5/25/2006	Hail	0.75 in.	0	0	0	0	None Reported
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Jonesboro	3/30/2007	Hail	0.88 in.	0	0	OK	OK	Isolated severe thunderstorms occurred in association with a weak warm front that extended eastward from a developing storm system over the Plains. Most of the severe weather events were marginally severe hail.
Union	7/19/2006	Heat	N/A	0	0	0	0	The heat index peaked between 105 and 110 across southern Illinois for up to three consecutive afternoons. At Carbondale, the heat index rose to 105 degrees on the 19th and 20th, and fell just shy of 105 on the 21st. At Mount Vernon, the heat index rose to 105 on the 19th, but did not reach that threshold on the 20th or 21st. At Cairo, the heat index peaked at 108 degrees on the 19th and 20th, and 105 on the 21st. The only three counties that did not register heat indices of at least 105 degrees were in the Lower Wabash Valley.
Union	8/1/2006	Heat	N/A	0	0	0	0	The heat index peaked between 105 and 113 degrees across southern Illinois on August 1st. Hourly measurements of the heat index peaked as high as 113 degrees at Harrisburg and Fairfield, 110 at Mount Vernon, 108 at Marion, 107 at Carbondale, and 105 at Cairo. Heat indices were a little lower in most areas the next day, but still peaked at or above 105 degrees in the Wabash Valley and near Cairo. The highest heat indices on August 2nd were 110 degrees at Fairfield, 108 at Harrisburg, and 105 at Cairo and Mount Vernon.
Union	8/19/2006	Heat	N/A	0	0	0	0	The heat index peaked between 105 and 110 degrees across far southern Illinois, mainly along and south of a line from Carbondale to Harrisburg. The highest hourly heat index readings were 109 degrees at Harrisburg, 107 at Carbondale, and 105 at Metropolis.

Union	8/9/2007	Heat	N/A	0	0	OK	OK	Surface high pressure located over the Deep South remained nearly stationary. A persistent hot and humid southwest wind flow around this high brought an extended period of dangerously high heat indices, ranging from 105 to 110 degrees on several afternoons. A number of persons were treated for heat exhaustion, including 37 at a Carbondale hospital. Several counties opened a cooling shelter.
Union	7/7/1995	Heat Wave	N/A	0	0	0	50K	Highs rose into the 90s with lows in the 70s for about two weeks. High humidity resulted in heat index values approaching 115 degrees. The prolonged heat caused parts of Interstate 57 to buckle. Illinois State Police diverted traffic from a badly damaged lane seven miles north of Cairo. At least one utility company reported that its all-time record for power usage was broken.
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Southern Il	8/10/1995	Heat Wave	N/A	0	1	0	0	Temperatures climbed well into the 90s with heat indices peaking around 115 degrees on some afternoons. This resulted in severe heat stress to livestock and crops. Many schools dismissed students early in the afternoon, and extra water coolers were brought in by some schools. At least one heat-related illness occurred at an elementary school. A student in Frankfort fainted after an outdoor recess, but she was not taken to a hospital.
Lick Creek	1/5/2005	Heavy Rain	N/A	0	0	0	0	In northeast Union County, Lick Creek went out of its banks and over Lick Creek Road and some low-lying farmland. Several hours of moderate to locally heavy rainfall occurred over ground that was saturated from persistent rain over the preceding several days. This resulted in standing water in many locations, and streams and ditches were near capacity. County authorities reported spotty flooding of roads, especially county roads.
Southern Illinois	3/8/1994	Heavy Snow	N/A	0	0	500K	0	Four to 12 inches of snow fell across southern Illinois. The heaviest snow fell in the far south tip near the Ohio River. Many schools and businesses were closed. There were many traffic accidents due to slick, snow-covered roads. Some older barns and homes suffered roof damaged from the weight of the snow in far southern Illinois.

Union	3/14/1999	Heavy Snow	N/A	0	0	0	0	A major snowstorm dumped as much as a foot of snow over parts of far southern Illinois. The hardest hit area was the Marion-Carbondale area, where 11 to 12 inches was measured. Because most of the precipitation fell as rain further south, little if any snow occurred from Metropolis to Shawneetown along the Ohio River. There was a sharp division between no snow and heavy snow. For example, in Johnson County (between Metropolis and Carbondale), accumulations ranged from 1 inch in the southeast corner to 7 inches in the northwest corner of the county. The swath of heaviest snow extended from Carbondale to Mount Carmel, where 9 to 12 inches fell. Other totals included 8 inches in Mount Vernon and Du Quoin, and 4 inches between Cairo and Anna. Snowfall rates were 1 to 2 inches per hour for several hours. This overtaxed the ability of most road crews to keep up with removal efforts. Interstate 57 was closed in the vicinity of Interstate 24 for several hours Sunday due to stranded tractor trailer rigs. In Johnson County, at least 30 vehicles slid off roads near Goreville. Drifting snow hampered road crews, forcing them to make several passes through previously cleared roads. Four-wheel drive vehicles and tractors were in high demand as smaller vehicles became stuck.
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Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	1/19/2002	Heavy Snow	N/A	0	0	0	0	Around four inches of snow fell across extreme southern Illinois, generally south of a line from Carbondale to Carmi. Lesser amounts of two to four inches fell north of there. Most of the snow fell in just a few hours time, when visibility was only around one quarter mile. Since surface temperatures were right near freezing during the event, snow removal was relatively easy. Traffic problems were relatively light because of the late night timing on a weekend. Some of the highest snowfall reports included: 4.5 inches at Grand Chain in Pulaski County, 4.3 inches at Carbondale, and 4 inches at Dixon Springs in Pope County.
Union	2/6/2003	Heavy Snow	N/A	0	0	0	0	A two-part winter storm dropped an average of 3 to 5 inches of heavy wet snow across extreme southern Illinois, mainly south of the Marion and Carbondale areas. The first round of snow occurred during the early morning and dropped 1 or 2 inches. The second round during the evening produced another 2 to 3 inches. Temperatures during the event were very close to freezing, and most of the accumulation was on grassy areas. Slushy roads were a concern at times, but the impact on travel was relatively minor. The snow was caused by an upper level disturbance moving east northeast from the Four Corners region. The highest reported snowfall amounts were along the Ohio River, including 4.5 inches at Metropolis and 4 inches at Cairo. Up to 3 inches of snow were reported as far north as Harrisburg, West Frankfort, and parts of the lower Wabash Valley around Grayville.
Union	2/23/2003	Heavy Snow	N/A	0	0	0	0	This snowstorm was short but intense. Visibility was less than one quarter mile during the heaviest snow bursts. The heavy snowfall rates were accompanied by thunder and lightning in a few spots. Total snowfall was 4 to 7 inches along and north of a line from Carbondale to Carmi, and 3 to 5 inches elsewhere. The counties along the Ohio River from Cairo to Elizabethtown received only an inch or two. The heavy snow was caused by an intense upper level disturbance that moved east-northeast from Oklahoma. The surface low pressure system tracked northeast from Arkansas into south central Kentucky during the night of February 23. Specific snowfall reports included 7 inches at Keensburg in Wabash County, 6 inches at Grayville (Edwards County), Pinckneyville (Perry County), and Mount Carmel (Wabash County), 5 inches at West Frankfort in Franklin County, 4.5 inches at Carbondale, and 4 inches at Harrisburg. This was the eleventh winter precipitation event of the season

								and brought the seasonal snowfall at Carbondale to more than 30 inches.
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	2/5/2004	Heavy Snow	N/A	0	0	0	0	Three to five inches of snow fell across most of southern Illinois, except for the far southern and eastern counties bordering the Ohio and Wabash Rivers, where only 2 or 3 inches fell. An area of intense snowfall moved northeast from southeast Missouri around midnight. Snowfall rates of 1 to 2 inches per hour were reported in southwest Illinois during the pre-dawn hours on the 5th. Thundersnow was observed at many locations across southern Illinois, with visibility below one quarter mile. The early morning commute on Feb. 5 was very messy. Numerous traffic mishaps were reported, and most schools were closed for the day. Illinois State Police district headquarters at DuQuoin reported almost 20 vehicles went off the road on their section of Interstate 57, including at least two semis. There were also five multi-vehicle accidents in the DuQuoin state police district, but no serious injuries were reported. Temperatures during this snowfall event were right near the freezing mark. As a result, the accumulation was wet and heavy. The snow was caused by a slow-moving upper level low near the Colorado/Kansas border. A weak surface low pressure center developed over Arkansas, then moved northeast into northern Tennessee by the evening of Feb. 5.
Union	10/22/1996	High Wind	0 kts.	0	0	28K	OK	High winds in the wake of a passing cold front caused isolated damage in southern Illinois. The most notable damage occurred at a farmstead near West Frankfort, where a steel grain bin was blown over and a large section of barn roof blew off.

Union	4/30/1997	High Wind	52 kts.	0	0	20K	0	Strong southwest winds, not related to thunderstorms, gusted between 50 and 60 MPH during the late afternoon. Scattered reports of downed trees and power lines were received. Large sections of Murphysboro were without power, as were parts of Marion, Carbondale, Anna, and Harrisburg.
Southern II	11/11/1995	High Winds	0 kts.	0	0	0	0	A very strong cold front moved through southern Illinois, causing temperatures to fall 20 degrees in 30 minutes. Strong winds behind the cold front caused some isolated power outages and minor tree damage. Power outages were reported in Williamson County, and a small tractor shed was blown over two miles north of Carterville.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	2/5/1996	Ice Jam	N/A	0	0	0	0	Extremely cold weather in early February caused ice jams to form along the Mississippi River north of Cairo. The U.S. Coast Guard closed the river from Cairo, IL to St. Louis, MO for a few days. There was 100 percent ice blockage near Thebes, Illinois for several hours. This caused the river to rise 6 feet at Cape Girardeau, but it remained well below flood stage. Scores of barges were trapped by ice, resulting in significant losses to the river industry. Once the ice started moving, several barges broke loose from their moorings and had to be rounded up by the Coast Guard. Numerous navigational aids were displaced or damaged by the ice.
Union	1/15/1997	Ice Storm	N/A	0	0	0	0	Freezing rain coated surfaces with around a half inch of ice. Travel became very difficult in a short period of time. The weather prompted Southern Illinois University in Carbondale to shut down for the fourth time in 30 years. The freezing rain virtually shut down several counties, closing schools, government offices, and health facilities. Franklin County was nearly paralyzed by the storm. Most Franklin County businesses and public offices closed for the day. A large number of vehicle accidents occurred, but no serious injuries were reported. State Route 13 in Jackson County and some county roads in Johnson, Pulaski, and Union Counties were closed because vehicles were unable to climb hills. The Southern Illinois Airport was closed for two hours. Hospitals brought in extra staff to handle an overload due to weather-related injuries. Mail delivery was cancelled in some areas due to icy conditions.

Union	1/1/1999	Ice Storm	N/A	0	0	150K	0	Significant ice accumulations caused travel problems across southern Illinois beginning late on New Years Day and continuing through the night. Traffic volume was especially light because it was a holiday weekend. Those who had to be out found roads extremely difficult to navigate. The hardest hit areas, from Carbondale to Benton and West Frankfort, experienced numerous power outages due to snapped tree limbs and power lines. A rural electric co-op reported slow progress in restoring power because of treacherous roads and fallen trees. Estimates of the number of residences without power were around 10,000, primarily in Franklin and Jackson Counties. Ice accumulations were estimated to be one-half to one inch thick in the area from Carbondale to DuQuoin and Mt. Vernon. Shelters were set up for those without heat, but few people took advantage of them. Local emergency rooms reported a sharp increase in slip-and-fall injuries. Dozens of vehicle accidents
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	1/8/1999	Ice Storm	N/A	0	0	0	0	Freezing rain coated surfaces with around a quarter inch of ice in most areas. The exception was in the vicinity of the Ohio River from Massac County to Hardin County, where locally one half inch of ice was observed. Many schools cancelled classes again, only a day after re-opening in the wake of an ice storm on January 2. A semi-trailer overturned on Interstate 57 just south of Marion. A total of 25 ice-related falls were recorded at Union County Hospital. This ice storm was considerably less serious than the ice storm of January 1 and 2, which hit the Carbondale and West Frankfort areas worst.
Union	1/25/2004	Ice Storm	N/A	0	0	0	0	The areas hardest hit by this ice storm were along and north of a line from Harrisburg to Carbondale, where about one half inch of ice glazed all surfaces. Numerous accidents were reported. At least one overturned vehicle and a jackknifed semi were reported on Interstate 57 between West Frankfort and Mount Vernon. Scattered power outages occurred as brisk winds downed ice-laden trees and power lines. One of the largest utility companies in southern Illinois reported about 1,500 customers without power. In Saline County, a downed power line blocked Illinois Route 34 near West End and U.S. Route 45 near Ledford. Most schools were closed for at least a day following the ice storm, which occurred on a Sunday. To the south of a line from Carbondale to Harrisburg, around one quarter inch of ice coated trees and power lines, but roads were mainly wet with scattered icy spots. There were some ice-laden tree limbs and power lines

								brought down by gusty winds. Illinois Route 145 in Massac County was one of a number of roads partially blocked by downed limbs.
Anna	8/27/2006	Lightning	N/A	0	0	20K	0	The steeple of a church was destroyed by lightning. The 25-foot tall steeple was sliced by the lightning strike and fell to the ground. The roof was damaged, allowing water to leak into the interior of the church and cause more damage.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	5/16/1995	River Flood	N/A	0	0	0	0	The Mississippi River flooded tens of thousands of acres of cropland. Losses were mainly agricultural, however estimates of crop damage were not yet available. Most of the non-agricultural damage was done to roads and bridges. In Union County, it was estimated \$700,000 damage was done to roads, levies, and other public structures. In Alexander County, the damage to public property was estimated at \$800,000. Almost all the damage to private property was crop damage, for which figures were unavailable. The American Red Cross set up a disaster relief center in Olive Branch to provide food and clean-up kits for flood victims and relief workers. Only three homes were evacuated in Alexander County, but well water was contaminated for many more, and electricity was shut off for others. A vital link between Illinois and Kentucky, the U.S. 60 bridge between Cairo, Illinois and Wickliffe, Kentucky, was closed over Memorial Day weekend. Officials were forced to close it when the water depth reached 15 inches over the Kentucky approach to the bridge. This was the first time since 1973 that floodwaters forced the closing of the bridge. Flooding in the Cairo area was considerably worse than in 1993 because the Ohio River was also over flood stage. At the confluence of the Ohio and Mississippi Rivers at Cairo, a state park was totally underwater. The 60 foot levee wall at Cairo was reinforced with sandbags, but was not in any danger of failing. Steep water coming up through the ground behind the levees was the main concern in Cairo. Sandbag walls were built to contain this sort of flooding, so damage was very minor. The flooding upstream from Cairo did not reach the levels of the 1993 flood. The U.S. Coast Guard halted all barge traffic from Cairo, Illinois northward for over a week. This was done in an effort to prevent wake damage, especially to levies which were in danger of being topped. The closure of the river was very expensive to the barge industry. The river crested at 47 feet, about 14 feet over flood stage, at Cape Girardeau, Missouri on May 24. The Ohio River crested at 55.6 feet at Cairo on May 25.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	6/1/1995	River Flood	N/A	0	0	1.9M	0	Near the Mississippi River, The Mississippi River continued to recede after cresting in late May. Nevertheless, the waters were still high enough in early June to keep some residents from their homes. Others were still forced to go to and from their homes by boat. Most rural roads near the river stayed closed into early parts of the month. Tens of thousands of bottomland remained submerged during the early part of the month. Damage to public property was tabulated to be \$809,000 in Alexander County, \$687,000 in Union County, and \$419,000 in Jackson County. Damage to private homes was relatively insignificant. No monetary estimate of crop damage was available.
Southern Il	12/8/1995	Snow	N/A	0	0	0	0	Between three and four inches of snow fell across most of southern Illinois. At least two dozen traffic accidents occurred, including a fatal crash near Mt. Vernon. A vehicle slid across the median of Interstate 57, colliding head on with another vehicle. Two people were killed. The snow closed one of the regional airports in the Carbondale area for most of the day.
Union	12/23/1998	Snow	N/A	0	0	0	0	A light snowfall, the first of the season in some areas, provided a one-inch coating. Road surfaces became extremely slippery, and numerous accidents were reported. Two of the accidents left drivers with major injuries and traffic backups stretching several miles. A tractor-trailer rig northbound on Interstate 57 near Marion jackknifed and crossed the median into the southbound lanes. The driver of a car that was struck by the truck was seriously injured. Traffic on Interstate 57 was detoured onto side roads until the accident could be cleared. Another accident on U.S. 51 about 8 miles south of Carbondale closed that road for a while. Three vehicles were involved in that wreck, and one person was seriously injured. Numerous other accidents were reported across the region, mostly minor.
Union	1/22/2000	Snow	N/A	0	0	0	0	Snow began during the morning hours and continued intermittently through the afternoon. Accumulations averaged only an inch or two, but roads still became quick slick. Slick roads may have contributed to a single-car accident in northern Pope County that critically injured a man.
Union	1/8/2006	Strong Wind	N/A	0	0	19K	0	Strong southwest winds were sustained from 30 to 35 MPH during the peak of this wind event. Measured wind gusts were as high as 45 MPH at the Carbondale airport.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	1/19/2006	Strong Wind	N/A	0	0	19K	0	Strong southwest winds were sustained around 30 MPH. Gusts were measured up to 48 MPH at Carbondale.
Union	2/16/2006	Strong Wind	N/A	0	0	14K	0	Strong winds gusted to between 40 and 50 MPH across most of southern Illinois except the Wabash Valley. At the Carbondale airport, the peak wind gust was measured at 49 MPH. Other airports recorded gusts from 40 to 45 MPH.
Union	12/1/2006	Strong Wind	N/A	0	0	1K	0K	A deepening low pressure system moved north across the Lower Ohio Valley. In the wake of the low, strong and gusty winds occurred. At airports near Cairo, Carbondale, Metropolis, and Harrisburg, highest sustained wind speeds were around 30 MPH, with peak wind gusts around 40 MPH. Winds were even higher in the Lower Wabash Valley, where peak wind gusts to 49 MPH were measured at Mount Carmel.
Cobden	8/29/2007	Thunderstorm Wind	N/A	0	0	6K	0K	A number of large trees were toppled. Isolated severe thunderstorms occurred during the heat of the day. The storms occurred along a weak cold front that extended southwest from low pressure over the Great Lakes region.
Reynoldsville	10/18/2007	Thunderstorm Wind	N/A	0	0	50K	0K	Trees and power lines were down across a road. The first of two rounds of severe weather occurred during the early morning hours. This first round was associated with strong low level southwest winds ahead of a deep low pressure center along the Missouri/Nebraska border. Most of the severe weather during the early morning hours was damaging wind associated with short lines of storms.
Ware	1/29/2008	Thunderstorm Wind	N/A	0	0	100K	0K	Roofs were blown off, and trees were blown down on U.S. Highway 51 south of Anna. East of Anna in the Mt. Pleasant area, numerous trees were down and structures were damaged. A roof was blown off a house west of Jonesboro. Countywide, a large number of trees and utility lines were blown down. A powerful cold front moved rapidly southeast across southern Illinois during the late afternoon hours. An organized line of severe thunderstorms developed along the front as it approached southern Illinois. Widespread damaging winds accompanied the line of storms. Temperatures fell about 30 degrees in less than one hour when the very strong cold front passed through.
Cobden To Anna	4/15/1994	Thunderstorm Winds	N/A	0	0	0	0	Several trees were blown down on old Route 51. A home suffered roof damage.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Reynoldsville	5/17/1995	Thunderstorm Winds	N/A	0	0	0	0	
Jonesboro	5/18/1995	Thunderstorm Winds	N/A	0	0	0	0	
Anna	5/18/1995	Thunderstorm Winds	N/A	0	0	0	0	
Union	6/8/1995	Thunderstorm Winds	N/A	0	0	50K	0	Numerous trees and power lines were blown down. Power was out for more than a day in some areas.
Jonesboro	11/11/1995	Thunderstorm Winds	N/A	0	0	40K	0	A nursing home was partially unroofed. About 12 residents of the home were relocated until the damage could be repaired. Trees were down and power was out in the area of the nursing home.
Union	3/4/1955	Tornado	F1	0	0	0K	0	None Reported
Union	11/16/1955	Tornado	F2	0	0	250K	0	None Reported
Union	5/21/1957	Tornado	F3	0	0	250K	0	None Reported
Union	8/9/1969	Tornado	F0	0	0	3K	0	None Reported
Union	4/14/1972	Tornado	F2	0	4	25K	0	None Reported
Union	4/14/1972	Tornado	F2	0	0	25K	0	None Reported
Union	6/2/1973	Tornado	F0	0	0	0K	0	None Reported
Union	2/16/1976	Tornado	F2	0	1	25K	0	None Reported
Reynoldsville	1/21/1999	Tornado	F2	0	0	20K	0	Top winds were estimated near 130 MPH. Damage was relatively light due to the track of the tornado over rural portions of those counties. A few sheds and barns were destroyed, and a house sustained moderate damage. A fairly large metal barn, about 100 feet by 50 feet, was blown into a stand of trees, but remained fully intact in the upper reaches of the trees. Tree damage was complete along some wooded portions of the track. The tornado formed less than a half mile east of Thebes, and then tracked seven miles through the Shawnee National Forest. The damaged structures were near Thebes and Gale.
Anna	1/21/1999	Tornado	F0	0	0	1K	0	A state police officer reported a brief touchdown near Anna. Damage was minimal, with just some fencing blown down.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Dongola	4/28/2002	Tornado	F3	1	8	5.0M	0	The tornado first touched down in very hilly terrain in the Shawnee National Forest and then tracked east, crossing Route 127 just north of Mill Creek. The tornado then directly struck the community of Dongola, where most of the damage and casualties occurred. A 69-year-old woman was killed as she was attempting to flee her mobile home. The woman had just gotten into her car, started the engine, and turned the lights on when the tornado struck. She was blown away from the car and found dead under a structure across the road from where the vehicle was parked and still running. Elsewhere in the Dongola area, a train was blown off the tracks. Several wood houses were demolished, and seven double-wide trailers were destroyed. Approximately 75 homes were damaged. A recreational vehicle was tossed across Lake Dongola and impaled into the ground. F69VE
Wayside	10/18/2004	Tornado	F1	0	0	4K	0	The tornado touched down in the extreme northeast corner of Union County, only about one-half mile from the Johnson County line. A metal machine shed was destroyed. The television antenna on a nearby home was blown down. Branches were blown down, and a few trees were snapped. The estimated winds were around 75 MPH. The tornado moved into northwestern Johnson County. A supercell thunderstorm organized over southern Jackson County, then spawned a tornado as it moved east along the Union/Williamson County line. This supercell continued east-southeast across northern Johnson and northern Pope Counties, producing two significant tornadoes and large hail. Although the storm exhibited strong rotation as it continued east through Hardin County and across the Ohio River into Kentucky, no additional tornadoes were reported there.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Jonesboro	3/1/2007	Tornado	F0	0	0	100K	0K	The tornado damage path began along a country road, then continued northeast over mostly open land for about one-half to three-quarters of a mile. The path then tracked along or nearly parallel to the same road until reaching the intersection of Highway 146. Several witnesses in the area observed a dark funnel bouncing up and down from the storm to the ground. Many trees were either uprooted or topped. One tree that landed on a house caused heavy damage and trapped a resident inside. The resident was freed from the home uninjured. About 15 to 20 homes received light to moderate roof damage. Several articles of debris were lodged from 20 to 50 feet up in the trees. There was some evidence of convergent damage based on how trees were blown down. Given the rapid storm speed of 50 to 60 MPH, all of the damage occurred in about two minutes. Peak winds were estimated near 75 MPH, resulting in a rating of EF (Enhanced Fujita) 0.A strong dry line or cold front moved rapidly east across the Mid-Mississippi and Lower Ohio Valleys during the midday hours. This feature trailed from a strong low pressure system that tracked from Kansas to Iowa. In advance of the front, numerous showers and thunderstorms developed. A particularly strong storm crossed the Mississippi River just north of Cairo and produced a brief tornado in Union County.
Wolf Lake	1/29/2008	Tornado	F1	0	0	10K	0K	The tornado crossed the Mississippi River from Cape Girardeau County, Missouri. During its short path in Union County, a large grain bin was blown onto a road. Numerous shingles were blown off a farm house. A couple of trees were uprooted. The average path width was 50 yards. Peak winds were estimated near 95 mph.A powerful cold front moved rapidly southeast across southern Illinois during the late afternoon hours. An organized line of severe thunderstorms developed along the front as it approached southern Illinois. Widespread damaging winds accompanied the line of storms. Temperatures fell about 30 degrees in less than one hour when the very strong cold front passed through.
Union	2/9/1960	Tstm Wind	65 kts.	0	0	0	0	None Reported
Union	3/16/1963	Tstm Wind	0 kts.	0	0	0	0	None Reported

Union	7/15/1966	Tstm Wind	0 kts.	0	0	0	0	None Reported
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	8/9/1969	Tstm Wind	61 kts.	0	0	0	0	None Reported
Union	9/28/1974	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	5/30/1976	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	5/30/1976	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	5/12/1978	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	9/22/1980	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	7/20/1981	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	8/24/1982	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	8/31/1982	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	12/25/1982	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	12/25/1982	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	7/5/1987	Tstm Wind	0 kts.	1	0	0	0	None Reported
Union	7/25/1988	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	8/27/1988	Tstm Wind	0 kts.	0	0	0	0	None Reported
Union	9/7/1990	Tstm Wind	0 kts.	0	0	0	0	None Reported
Anna	1/18/1996	Tstm Wind	0 kts.	0	0	5K	0	Power poles were broken.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Anna	5/5/1996	Tstm Wind	0 kts.	0	2	50K	0	A house was damaged in Dongola along with trees and power lines. Extensive damage occurred in Anna, where two persons were injured by shattered windows. Numerous trees and power lines were downed. A couple trees fell on homes. A new school bus was damaged when a piece of metal blew through the windshield.
Anna	4/20/1997	Tstm Wind	0 kts.	0	0	5K	0	Trees and power lines were blown down.
Anna	7/14/1997	Tstm Wind	50 kts.	0	0	4K	0	A utility pole was down.
Dongola	5/21/1998	Tstm Wind	50 kts.	0	0	5K	0	Trees were blown down.
Ware	6/14/1998	Tstm Wind	52 kts.	0	0	3K	0	State police estimated wind gusts to 60 MPH. At least one large tree was blown down.
Anna	6/29/1998	Tstm Wind	55 kts.	0	0	30K	0	A fruit orchard sustained extensive damage. Many apple trees were uprooted or snapped, and a portion of a barn roof was peeled back.
Anna	1/22/1999	Tstm Wind	0 kts.	0	0	20K	0	A large shed was destroyed by thunderstorm winds.
Union	5/17/1999	Tstm Wind	0 kts.	0	0	250K	0	High winds from a line of thunderstorms caused widespread damage across Union County. Hundreds of downed trees and power lines were reported. In Cobden, community officials estimated 100,000 dollars damage occurred. Children escaped injury at an elementary school in McClure when storms blew off the gymnasium's roof. Damaging winds caused extensive damage in Anna, where numerous trees and limbs were blown down. A one-story frame house in Anna was flattened by a falling tree. In Jonesboro, there were small trees down and 10-inch diameter limbs. Two houses in Jonesboro sustained some of the worst storm-related damage due to trees smashing into them. Power was out for more than 12 hours in some areas, prompting the cancellation of some schools the following day. In East Cape Girardeau, grain bins were heavily damaged.
Union	2/24/2001	Tstm Wind	0 kts.	0	0	8K	0	About a half dozen reports were received of trees falling on roads.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	10/24/2001	Tstm Wind	52 kts.	0	0	20K	0	Numerous trees were blown down. The hardest hit areas were Anna and Joneboro, where a number of roads were blocked by downed trees and power lines. An awning was blown off a business. Utility poles were knocked over on the east side of Anna, closing Illinois Route 146. Some minor structural damage was reported.
Cobden	4/21/2002	Tstm Wind	50 kts.	0	0	0	0	Two trees were down in the Trail of Tears State Park.
Anna	7/10/2002	Tstm Wind	50 kts.	0	0	3K	0	Large tree limbs were blown down. A person driving between Anna and Lick Creek had a large limb come down on her car, causing sizeable damage to it.
Saratoga	11/9/2002	Tstm Wind	52 kts.	0	0	5K	0	A few trees were blown down, and lots of tree branches were down. The diameter of the downed trees was estimated to be 12 inches.
Union	5/6/2003	Tstm Wind	50 kts.	0	0	0	0	Trees were blown down, including some that fell across roads.
Alto Pass	7/18/2003	Tstm Wind	50 kts.	0	0	0	0	A couple of trees were blown down on major roads in northern Union County, including Route 3 near Wolf Lake and Highway 127 at Alto Pass. A cluster of thunderstorms became severe over the Carbondale area, producing wind gusts near 60 MPH. The storms continued to produce isolated reports of tree damage as they organized into a line and moved south.
Jonesboro	7/18/2003	Tstm Wind	50 kts.	0	0	0	0	A couple of trees were blown down on Route 127. A cluster of thunderstorms became severe over the Carbondale area, producing wind gusts near 60 MPH. The storms continued to produce isolated reports of tree damage as they organized into a line and moved south.
Ware	8/4/2003	Tstm Wind	50 kts.	0	0	0	0	An outbuilding was blown down by thunderstorm winds.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Jonesboro	5/30/2004	Tstm Wind	50 kts.	0	0	0	0	Widespread damaging winds raked all of southern Illinois. The storms were in the form of short lines or bows as they moved through Jefferson, Perry, and Jackson Counties, including Mount Vernon and Carbondale. A couple of tornadoes were spawned in those areas. As the storms moved east, they evolved into an intense squall line, producing widespread damaging gusts around 60 MPH with isolated higher gusts to 90 MPH. Numerous trees were blown down in nearly every county. Some of the trees fell on roads and power lines. In Wayne County, trees and utility poles were down in Sims, but the northwest part of the county from Orchardville to Johnsonville was hardest hit with utility damage. In Hamilton County, the whole city of Mcleansboro was without power after numerous trees fell. Several of the trees landed on houses, causing severe damage to at least one house. Trees fell on vehicles in Mount Carmel, where gusts were reported to 68 MPH. At least two occupied vehicles were struck by falling trees, one on Route 34 north of Harrisburg, and another north of Old Shawneetown. In both cases, the occupants were freed by rescue workers without being injured. In Harrisburg, trees fell on several houses and vehicles, and a radio tower used for fire dispatch operations was blown down. Two roofs were blown off of houses in Raleigh, just north of Harrisburg. A tree fell on a house in Thebes, near the Mississippi River in Alexander County. The most intense winds (estimated near 90 MPH) occurred in Massac County about 5 miles west of Round Knob, where a house lost portions of its roof and attic. At least 10 to 15 trees were reported down in Massac County. The storms produced very heavy rain that caused street flooding. The U.S. Highway 51 overpass on the north side of Cairo was blocked by high water.
Alto Pass	6/12/2004	Tstm Wind	50 kts.	0	0	0	0	Trees were down on Route 127 about two miles north of Route 146.
Dongola	6/18/2004	Tstm Wind	50 kts.	0	0	0	0	Several trees were blown down near U.S. Highway 51.
Dongola	6/18/2004	Tstm Wind	50 kts.	0	0	0	0	Several trees were blown down near U.S. Highway 51. A supercell severe thunderstorm moved across the Mississippi River southwest of Carbondale, passing southeast across Union County and southwest Johnson County, before reaching the Ohio River near Metropolis. The storm produced large hail up to baseball size, along with isolated damaging wind gusts that downed trees.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Anna	11/6/2005	Tstm Wind	50 kts.	0	0	0	0	Three trees were down on St. John's Road, off of U.S. Highway 127.
Cobden	11/15/2005	Tstm Wind	56 kts.	0	0	10K	0	A microburst with wind speeds of 60-70 mph damaged several mobile homes. Two of the mobile homes had their roofs torn off, six others sustained minor damage. Several large tree limbs were down and a few trees were snapped off at their bases. A house and shed received minor roof damage.
Anna	3/9/2006	Tstm Wind	57 kts.	0	0	40K	0	Two buildings and a pole barn were damaged. A restaurant sustained roof damage.
Cobden	4/30/2006	Tstm Wind	61 kts.	0	0	50K	0	In Cobden, a farmstead was heavily damaged. The chimney of a house fell and smashed through a deck. A carport was destroyed. A boat was blown 75 feet, and a barn was unroofed. On the neighboring property, three outbuildings were destroyed and nine trees were blown down. Other trees and power lines were down in the Cobden area. A house was damaged four miles north of Cobden.
Ware	5/25/2006	Tstm Wind	50 kts.	0	0	0	0	Numerous large tree limbs were down.
Anna	7/14/2006	Tstm Wind	50 kts.	0	0	0	0	On the east side of Anna, a couple of trees were blown down across roads.
Jonesboro	8/10/2006	Tstm Wind	50 kts.	0	0	3K	0	Power lines were blown down.
Union	12/1/1998	Unusual Warmth	N/A	0	0	0	0	Temperatures averaged 20 to 30 degrees above normal during the first week of the month. Highs were around 70 most of the week. The heating industry reported some loss of revenue as a result of the weather. A gas company reported the average customer's bill was down 27 percent from the same time last year. Other businesses, such as the outdoor construction industry, benefited from the extended period of warmer weather.
Union	1/3/2000	Urban/sml Stream Fld	N/A	0	0	0	0	A series of thunderstorm complexes dumped over 4 inches of rain in a 24-hour period. A period of intense rainfall produced rapid rises in creeks and small streams, as well as some urban street flooding in Marion. No flood damage was reported.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	4/20/2000	Wind	N/A	0	0	0	0	Strong gusty west winds in the wake of a cold front caused scattered reports of minor wind damage. Peak gusts were measured around 50 MPH. There were several reports of downed trees and power lines. In Albion in Edwards County, a large oak tree was uprooted and smashed onto a trailer. Although the trailer was badly dented, the roof did not collapse.
Union	3/9/2002	Wind	N/A	0	0	3K	0	Minor property damage was caused by strong west winds around the back side of an intense low pressure system. Winds gusted to around 45 MPH for several hours. Some exact wind measurements from automated observing sites included: 45 MPH at Harrisburg and Mount Vernon, and 42 MPH at Carbondale. Just west of Pinckneyville, gusts to 48 MPH occurred. A couple of power lines were blown down in Carmi.
Union	1/2/1996	Winter Storm	N/A	0	0	0	0	A major winter storm affected parts of southern Illinois. Snowfall amounts increased from south to north, with up to 8 inches reported at Mount Vernon. Warmer temperatures closer to the Kentucky border resulted in a mixture of precipitation types. Only an inch of snow was measured in northern Pope County, less than 20 miles from the Ohio River. Benton reported 5 inches, Anna had 3 inches, and Pinckneyville reported 4 inches. In the most affected areas, including Mount Vernon, hotels were booked with holiday travelers seeking to avoid dangerous travel conditions. In Jefferson County alone, 36 weather-related accidents occurred, none with serious injuries. A school bus carrying 30 students slid into a ditch, but nobody was hurt. Most schools cancelled classes the following day. Gusty winds and very cold temperatures hampered snow removal efforts. Winds gusted to 25 MPH with temperatures in the teens.
Union	1/6/1996	Winter Storm	N/A	0	0	0	0	A moderate snowfall, averaging 3 to 4 inches, affected all of southern Illinois. Strong gusty winds piled the dry, powdery snow into waist-high drifts in some spots. This contributed to dozens of auto accidents, including a van that slid into a guard rail on Interstate 57 near Mount Vernon. Several people were injured in this mishap. A man in Benton suffered a fatal heart attack while he was shovelling snow. Five people were treated for slip-and-fall injuries, including three fractures. The deep drifts were over car roofs in open farm country of one southeast Illinois county. Several vehicles became stuck. State Highway 161 was reduced to one lane of travel in spots due to drifts.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	12/16/1996	Winter Storm	N/A	0	0	0	0	A narrow band of heavy snow, only about 25 miles wide, extended from Carbondale northeastward through Mt. Vernon. Maximum totals in this band were from 5 to 7 inches, including 5 inches at Carbondale and 7 inches in northwest Hamilton County. The surprise snowstorm gave thousands of students the day off from school. Numerous vehicles slid off roads, but no injuries or major damage was reported. Local hardware stores quickly sold out of winter supplies. The storm began as rain, then changed briefly to sleet and freezing rain before turning to heavy snow.
Union	1/8/1997	Winter Storm	N/A	0	0	0	0	A low pressure system moved northeast across the Tennessee River Valley, producing up to 7 inches of snow in southern Illinois. Generally 5 or 6 inches fell north of Marion and Carbondale to Mt. Vernon and Fairfield. South of the Marion-Carbondale area and in the Wabash River Valley, snowfall amounts were 3 to 4 inches. Most schools closed due to the storm.
Union	12/13/2000	Winter Storm	N/A	0	0	0	0	A major winter storm produced 4 to 7 inches of snow across southern Illinois, followed by 1/4 to 1/2 inch of ice. The snow began during the early morning hours, falling at rates near one inch per hour. By midday, the snow changed to freezing rain after a brief period of sleet. Light to occasionally moderate freezing rain fell during the afternoon and early evening hours. The heavy precipitation was caused by a strong upper level disturbance that tracked east-northeast from the southern Rockies, across the southern Plains, and then over the lower Mississippi Valley. A strong southerly flow of milder air just above ground level was unable to scour out very cold air right at the surface, which produced an extended period of snow and ice. The liquid equivalent of all the frozen and freezing precipitation was between three quarters of an inch and one inch. Numerous accidents occurred, most of which were minor. The most significant accident was at the junction of Interstates 57 and 64 near Mount Vernon, where a jack-knifed semi-trailer held up traffic for more than an hour. Schools were closed for up to a week following the storm, especially in rural counties with limited snow removal resources. Ice on trees and power lines contributed to scattered power outages. Stores quickly sold out of winter goods, such as ice melter and snow shovels.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	2/21/2001	Winter Storm	N/A	0	0	0	0	Several hours of moderate to heavy sleet and freezing rain occurred, sometimes accompanied by thunder and lightning. The precipitation was mainly in the form of sleet in most areas, with up to an inch of sleet accumulation. In the southernmost tip of Illinois, from Cairo to Metropolis, freezing rain was more prevalent. Freezing rain glazed some surfaces, mainly trees and power lines, with up to one quarter inch of ice. On the day following the storm, numerous schools were closed. The liquid equivalent of the precipitation ranged from one quarter inch at Carbondale to just under an inch over the southern tip of Illinois near Cairo.
Union	12/4/2002	Winter Storm	N/A	0	0	0	0	A major winter storm brought significant snow and ice accumulations to all of southern Illinois. The precipitation was mostly snow, except in counties bordering the Ohio River, where the snow changed to an extended period of freezing rain. Ice accumulations were around one quarter inch from Cairo to Metropolis and Golconda. Snow accumulations across southern Illinois were generally six to eight inches. Freezing rain kept amounts down to near 4 inches in counties bordering the Ohio River. From Pinckneyville and Mount Vernon to the Wabash Valley, the snow fell in two distinct bursts, with two to three inches during the midday hours, followed by another two or three inches during the late night hours. The spotty 8-inch snowfall amounts were reported in a band between Illinois Route 13 and the Shawnee National Forest. Travel was heavily impacted by the winter storm. Numerous vehicle accidents occurred. Schools were closed for the remainder of the week in some counties. The winter storm began during the early morning hours and ended late the following night.

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	12/23/2002	Winter Storm	N/A	0	0	0	0	A winter storm over parts of southern Illinois occurred in two parts. The first round consisted of a band of sleet and snow during the evening of the 23rd. Two to four inches of sleet and snow accumulated in a band from Carbondale to Harrisburg and Carmi. The precipitation was mainly sleet east of the Marion and Carbondale area, where amounts were close to two inches. The second part, on the afternoon of the 24th, consisted of several hours of heavy snow in much the same area. Three to six inches of snow fell along and north of a line from Carbondale to Harrisburg. This brought storm total accumulations to 7 inches in places such as Pinckneyville, Murphysboro, and West Frankfort. The snowfall diminished rapidly to the south, with only a dusting along the Ohio River between Cairo, IL and Paducah, KY. On the south side of the heavy snow area, significant ice accumulations occurred over much of the Shawnee National Forest region, roughly along the Illinois Route 146 corridor from Anna to Golconda. About one quarter inch of ice glazed trees, wires, and fences. Numerous accidents were reported throughout southern Illinois. Saline County officials received 32 calls for emergency assistance, mostly due to vehicles in ditches. A few serious accidents with injuries occurred. A rollover accident on Route 145 injured four people.
Union	1/16/2003	Winter Storm	N/A	0	0	0	0	The storm hit during the morning commute time on a weekday, so it had a major impact on traffic. The snow fell at the rate of 1 to 2 inches per hour around the morning drive time. Many schools cancelled classes. By noon, most of the accumulating snow had ended, leaving a blanket of 3 to 4 inches in most places. Cold temperatures limited the effectiveness of salt used by road crews, and some minor blowing and drifting occurred. Temperatures were in the 20's during the snowstorm, and around 10 by the morning of the 17th. Refreezing of moisture occurred after dark, causing another round of accidents after the snow had ended. The snow was caused by a moderately strong upper level disturbance that moved east from the Plains, then across Tennessee. A weak low pressure system followed about the same path, passing just south of Missouri and Kentucky. Some specific snowfall amounts included: 4 inches at Cairo and Mound City, and 3 inches at Anna (Union County) and Eddyville (Pope County). Only the southern tip of Illinois received these heavier snow totals. Carbondale and points north received 2 inches or

								less.
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	2/16/2003	Winter Storm	N/A	0	0	0	0	A long-lasting sleet storm affected southern Illinois. The precipitation was almost all sleet south of the Marion/Carbondale area, where an inch or two was reported. Along and north of a Carbondale to Harrisburg line, there was more snow, with total accumulations of sleet and snow in the 3 to 6 inch range. Specific reports included: 6 inches at Pinckneyville in Perry County, 5.5 inches near Mount Carmel in Wabash County, 4.5 inches at West Frankfort in Franklin County, 4 inches at Carbondale, and 2.4 inches at Harrisburg in Saline County. The storm occurred on the Presidents Day weekend. Most schools and businesses scheduled to be open on Presidents Day were closed. Franklin County officials reported about 25 accidents in that county alone, none of which involved injuries.

Union	12/22/2004	Winter Storm	N/A	1	1	100K	0	A major winter storm dumped from 10 to 20 inches of snow across most of southern Illinois, clogging interstates and shutting down most businesses near the peak of the Christmas shopping season. The heaviest snowfall, from 14 to 20 inches, occurred along an axis from Anna (Union County) through Harrisburg (Saline County) to the lower Wabash Valley. Snowfall was not quite as heavy from Fairfield (in Wayne County) west across Mount Vernon to Du Quoin (Perry County), where amounts were mostly from 6 to 9 inches. On the north side of Anna in Union County, a man was killed and another man was injured when an awning on a VFW Post collapsed on them. The two men were standing under the 12-by-30 foot awning when it collapsed. The weight of the compacted snow, which fell several days earlier, caused the metal roof to totally collapse over the men. The other end of the awning remained partially standing. A crew of 15 to 20 rescuers took about 30 minutes to extricate the men. In Johnson County, the roof of a hardware store and a horse arena collapsed under the weight of the snow and ice. Portions of Interstates 57, 64, and 24 were extremely difficult to travel. Numerous abandoned vehicles and jack-knifed semis blocked portions of these highways, however, none were officially closed. Interstate 64 was closed at the Indiana state line. The near blizzard conditions stranded many interstate travelers in hotels, and some hotels on Interstates 64 and 57 were totally filled. State police took some stranded motorists to an emergency shelter at the Marion Senior Citizens Center, where at least 8 people spent the night. Gusty north winds from 15 to 25 MPH with a few gusts to 35 MPH caused blowing and drifting.
Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description

Union	2/11/2008	Winter Storm	N/A	0	0	1.0M	OK	<p>Low pressure developed over the southern Plains, spreading widespread heavy precipitation across southern Illinois. At the same time, high pressure over the upper Ohio Valley produced a cold easterly wind flow. The result was a crippling ice storm. Around one inch of ice caused extensive damage across far southern Illinois, along and south of a line from Carbondale and Marion to Harrisburg and Carmi. Many of those same areas received three to six inches of sleet and snow. The most destructive icing occurred in an east to west band across Union, Johnson, Massac, and Pope Counties. The state designated most counties in southern Illinois as a disaster area. Numerous trees and power lines were brought down, knocking out power to many thousands of homes. Power outages lasted up to a week. An indirect fatality occurred in Carbondale, where an elderly man died of carbon monoxide poisoning while operating a gasoline generator in his garage. Three carbon monoxide poisonings were reported in Christopher. All three victims, who were from the same family, were not seriously injured. Emergency shelters were established for those without power for extended periods. Schools were closed for a week in some counties. Trees and tree limbs fell across roads, complicating recovery efforts. A number of houses and other structures were damaged by falling trees. The roof of a bakery and bread store in Herrin collapsed under the weight of the ice and snow. The walls of the store bowed out due to the collapse, and the structure was deemed a total loss. Ferne Clyffe State Park, Tunnel Hill State Bike Trail, and the Trail of Tears State Forest were closed for the remainder of the month due to widespread tree damage. Minor damage occurred to facilities and buildings in Ferne Clyffe State Park. To the north of the Marion, Carbondale, and Harrisburg areas, one to three inches of sleet and snow, and up to one-half inch of freezing rain occurred.</p>
Union	2/3/2007	Winter Weather	N/A	0	0	OK	OK	<p>An upper level storm system swept southeast from Missouri across the Tennessee Valley. A very dry and powdery inch of snow fell across the southern tip of Illinois, mostly south and southeast of the Marion/Carbondale area. Roads were snow-covered and slick.</p>

Location or County	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Description
Union	12/15/2007	Winter Weather	N/A	0	0	OK	OK	An upper level low moved east across southern Illinois. Strong northwest winds in the wake of a surface low over central Kentucky brought enough cold air for snow. The rain changed to snow and accumulated from 1 to 3 inches over all but the Ohio River counties. The snow fell heavily at times, accumulating 2 inches in 3 hours at Du Quoin in Perry County. Roads became snow-covered and slushy. Vehicles slid off roads, including U.S. Highway 51 north of Carbondale. The snow accumulated to a depth of 3 inches in West Frankfort (Franklin County), 1.5 inches in Harrisburg (Saline County), and 2.5 inches in Du Quoin (Perry County). Pinckneyville (Perry County) measured 2 inches, and Carbondale measured one inch. In Union County, 2 inches was reported near Anna. In Wayne County, 2.5 inches fell near Cisne.
Union	1/22/2003	Winter Weather/mix	N/A	0	0	0	0	One to three inches of snow fell across southern Illinois during the afternoon and early evening. Roads became very slick and hazardous.
Union	12/8/2005	Winter Weather/mix	N/A	0	0	0	0	One to three inches of snow fell across much of southern Illinois. The lowest amounts were about an inch near Metropolis, along the Ohio River. The three-inch amounts extended from Pinckneyville eastward to Benton and Harrisburg. Amounts were even higher along the Interstate 64 corridor and in the Lower Wabash Valley. The precipitation started as sleet and freezing rain, especially along and east of a Cairo to Harrisburg line. Roads were very slippery, resulting in numerous accidents. Over 50 accidents occurred in Franklin County in just a few hours. Traffic on Interstate 57 was partially blocked by a jackknifed semi-trailer in Franklin County south of Benton. At the Benton interchange of I-57, a northbound exit ramp was shut down. Some of the accidents on Interstate 57 involved injuries.
Union	2/18/2006	Winter Weather/mix	N/A	0	0	0	0	One to two inches of snow fell across southern Illinois. Isolated amounts of 3 inches occurred in Fairfield (Wayne County), Pinckneyville (Perry County), and Mount Carmel (Wabash County). Roads were snow-covered and slippery.
Union	2/19/2006	Winter Weather/mix	N/A	0	0	0	0	Two inches of snow fell over far southern Illinois, mainly south of the Marion/Carbondale area and in counties bordering the Ohio River. Roads were initially wet, then became ice and snow-covered as the precipitation continued.
TOTALS:				12	119	12.032M	53.051M	

Appendix E: Historical Hazard Maps

Please See PDF Files on Disk or Attached Maps

Appendix F: Critical Facilities

Airport Facilities Report

ID	Name	Address	City	Class	Function	Capacity	Year Built	Replacement Cost*
1	HOUSEMAN		COBDEN	ADFLT	Private			6049.5
2	KEIL		DONGOLA	ADFLT	Private			6049.5
3	LAMBDINS FIELD		WOLF LAKE	ADFLT	Private			6049.5

* Replacement costs are in thousands of dollars.

Communication Facilities Report

ID	Name	Address	City	Class	Owner	Function	Replacement Cost
1	WNIB369	I57 INTERCHANGE 3 MI W	GOREVIL	CBR	E T SIMONDS		
2	WNIB369		GOREVIL	CBR	E T SIMONDS		
3	WPKB542	2695 MT OLIVE RD	DONGOLA		CBR EDDLEMAN,		
4	WPKB542		DONGOLA		CBR EDDLEMAN,		
5	WPBG789	.3 MI W OF GOREVILLE & I-157	GOREVIL	CBR	EXPRESS		
6	WPBG789		GOREVIL	CBR	EXPRESS		
7	WNZL909	BALD KNOB MOUNTAIN 2 MI SW	ALTO	CBR	FORBY, RUSSELL		
8	WNZL909		ALTO	CBR	FORBY, RUSSELL		
9	KNDW753	APPROX 3 MI E	WOLF	CBR	GLASCO, GARRY		
10	WPXV526	2605 Dog Walk Road	Anna	CBR	Grant, Larry		
11	WPXV526		Anna	CBR	Grant, Larry		
12	WQCW494	500' SE Int SR146 and ICRR tracks	Anna	CBR	IL Centrail RR Co		
13	WQCW494		Anna	CBR	IL Centrail RR Co		
14	WNIG634	.1 MI SE INT SR 146 AND ICGRR	ANNA	CBR	IL CENTRAL		
15	WNEQ575	.1 MI SE INT OF SR 146 AND ICG RR IN	ANNA	CBR	IL CENTRAL		
16	KBG325	UNION COUNTY REFUGE 2 MI SE	WARE	CBR	ILLINOIS, STATE		
17	KBK253	4.7 MI NW	COBDEN	CBR	ILLINOIS, STATE		
18	KBK257	1000 N MAIN MAIN BLDG	ANNA	CBR	ILLINOIS, STATE		
19	KBK257	1000 N MAIN INFO BLDG	ANNA	CBR	ILLINOIS, STATE		
20	KSB913	JCT IL RT 3 & IL RT 146	WARE	CBR	ILLINOIS, STATE		
21	KXR832	2 MI S OF	MAKANDA		CBR ILLINOIS, STATE		

ID	Name	Address	City	Class	Owner	Function	Replacement Cost
22	WBH453	4.7 MI NE OF	COBDEN	CBR	ILLINOIS, STATE		
23	WNBM808	4.7 MI NE	COBDEN	CBR	ILLINOIS, STATE		
24	WNCQ253	Trail f Tears St Forest Maintenance Shop	Jonesbor	CBR	ILLINOIS, STATE		
25	WQDF391	BALD KNOB ROAD	ALTO	CBR	ILLINOIS, STATE		
26	WQDF391		ALTO	CBR	ILLINOIS, STATE		
27	WQDG570	2 MI S OF MIKANDA, 4.7 M NE	COBDEN	CBR	ILLINOIS, STATE		
28	WQDG570		COBDEN	CBR	ILLINOIS, STATE		
29	WQFM342	2 MI S OF MAKANDA 4.7 MI NE	COBDEN	CBR	ILLINOIS, STATE		
30	WQFM342		COBDEN	CBR	ILLINOIS, STATE		
31	WSK563	3 MI W OF GOREVILLE & I57	GOREVIL	CBR	J & O		
32	WSK563		GOREVIL	CBR	J & O		
33	WBS688	212 W VIENNA	ANNA	CBR	J W REYNOLDS		
34	WPKD753	12 MI DUE W OF INT OF I24 I57	COBDEN	CBR	J&L ROBINSON		
35	WPKD753		COBDEN	CBR	J&L ROBINSON		
36	WPCE596	600 E OF INT OF IL RT 3 & 146	JONESB	CBR	JACKSON		
37	WPCE596		JONESB	CBR	JACKSON		
38	WQID259	309 COOK AVE	JONESB	CBR	JONESBORO		
39	WQID259		JONESB	CBR	JONESBORO		
40	KRU977	100 PUBLIC SQUARE	JONESB	CBR	JONESBORO,		
41	WPMP381	100 PUBLIC SQUARE CITY HALL	JONESB	CBR	JONESBORO,		
42	WPMP381		JONESB	CBR	JONESBORO,		
43	KUC903	1.2 MILES WEST OF ANNA	ANNA	CBR	JOPLIN		
44	WPUB647	500 Big City Park Road	Cobden	CBR	KFVS LICENSE		

ID	Name	Address	City	Class	Owner	Function	Replacement Cost
45	WPQE286	19 KM W OF THE INTER OF	COBDEN	CBR	LINDELL MAY		
46	WPQE286		COBDEN	CBR	LINDELL MAY		
47	WPMV502	2135 ALDRIDGE ROAD	COBDEN	CBR	LOFTON, MIKE		
48	WPMV502		COBDEN	CBR	LOFTON, MIKE		
49	WHG718	STATION 19 2 MI SW	ALTO	CBR	Maritime		
50	WNBA781	APPROX1 MI NW OF BALD KNOB	ALTO	CBR	M DBA MC LANE		
51	WNBA781		ALTO	CBR	M DBA MC LANE		
52	KNDL908	1/2 MI E IL HWY 146	ANNA	CBR	MELLER JAMES		
53	WSV592	1 BLK E OF OLD RT 51 ON NORTH SIDE	COBDEN	CBR	MIDDLETON		
54	WSV592		COBDEN	CBR	MIDDLETON		
55	WPNX260	3930 WARE-WOLF LAKE ROAD	WOLF	CBR	MYERS, RANDY		
56	WPNX260		WOLF	CBR	MYERS, RANDY		
57	WNRQ882	3 MI W OF GOREVILLE & I57	GOREVIL	CBR	Nextel License		
58	WNRQ882		GOREVIL	CBR	Nextel License		
59	KNAK415	2.1MI S OF ALTO PASS	ALTO	CBR	NIEDERBRACH		
60	WGJ809	2.1 MI SW	ALTO	CBR	NIEDERBRACH		
61	WPPH958	SUMMIT OF WATER VALLEY RIDGE	MAKANDA		CBR NOVA COM		
62	KNHA826	1 MI N	ALTO	CBR	ALTO PASS		
63	KNHA826		ALTO	CBR	ALTO PASS		
64	KNNT730			CBR	ALTO PASS		
65	KLJ329	RT 146 E OF ANNA RR 1	ANNA	CBR	Ameren Services		
66	KSE521	1.5 MI SW	ALTO	CBR	Ameren Services		
67	KSE55	1.5 MI SW OF	ALTO	CBR	Ameren Services		

ID	Name	Address	City	Class	Owner	Function	Replacement Cost
68	KSI40	RTE 146 E OF	ANNA	CBR	Ameren Services		
69	KZB401		ANNA	CBR	Anna Hospital		
70	KZB401	517 N MAIN ST	ANNA	CBR	Anna Hospital		
71	WNHU809	517 N MAIN ST	ANNA	CBR	Anna Hospital		
72	WNHU809		ANNA	CBR	Anna Hospital		
73	WNYG519	1.25 MI E 1.25 MI S JCT RT 146 127	JONESB	CBR	ANNA		
74	WNYG519		JONESB	CBR	ANNA		
75	WRN901	RT 51 2 MI N	ANNA	CBR	ANNA QUARRIES		
76	WQHE453	1000 QUARRY RD	ANNA	CBR	ANNA		
77	WQHE453		ANNA	CBR	ANNA		
78	WPLS715	125 W DAVIE	ANNA	CBR	ANNA, CITY OF		
79	WPLS715		ANNA	CBR	ANNA, CITY OF		
80	KNKK555	1000 NORTH MAIN STREET	ANNA	CBR	Arch Wireless Lic		
81	KNDH426	APPROX 1 3/4 MI SE	ANNA	CBR	BOYD, COLLIN		
82	WNGE560	1 MI NW BALD KNOB LOOKOUT TWR	ALTO	CBR	BUDDY BUDDY		
83	WNGE560		ALTO	CBR	BUDDY BUDDY		
84	WRH608	1/2 MI E 1/4 MI S RT 3 & 146 JCT	WARE	CBR	CAIN, COLLIN		
85	WRH608		WARE	CBR	CAIN, COLLIN		
86	KNKN477	2695 BALD KNOB ROAD	COBDEN	CBR	Cellco Partnership		
87	WPON601	525 EAST JEFFERSON STREET	ANNA	CBR	Cellco Partnership		
88	WPOU551	19 KM W INT I-24 & I-57	COBDEN	CBR	Cellco Partnership		
89	WPQL879	2695 BALD KNOB ROAD	COBDEN	CBR	Cellco Partnership		
90	KNKN477	2695 BALD KNOB ROAD	COBDEN	CBR	Cellco Partnership		

ID	Name	Address	City	Class	Owner	Function	Replacement Cost	91
KNKN477		249 Rhymer Road	McClure	CBR	Cellco Partnership			
92	KNKN477	2695 BALD KNOB ROAD	COBDEN	CBR	Cellco Partnership			
93	WPQL879	2695 BALD KNOB ROAD	COBDEN	CBR	Cellco Partnership			
94	WPPC393	ON SKYLINE DR APPROX 3.7KM SE	ALTO	CBR	COBDEN U			
95	WPPC393		ALTO	CBR	COBDEN U			
96	WPPF486	SKYLINE DR APPROX 3.7 KM SE	ALTO	CBR	COBDEN U			
97	WPPF486		ALTO	CBR	COBDEN U			
98	KNFP509	APPLEKNOCKER ST FIRE STA	COBDEN	CBR	COBDEN, CITY OF			
99	WPFW507	112 E MAPLE ST	COBDEN	CBR	COBDEN,			
100	WPFW507		COBDEN	CBR	COBDEN,			
101	WPQF816	19 KM W OF THE INTER OF INTER 24	COBDEN	CBR	CONT WASTE			
102	WPQF816		COBDEN	CBR	CONT WASTE			
103	WPYI384	6785 STATE RT 3 SOUTH	MCCLURE		CBR D & D FARMS			
104	WPYI384		MCCLURE		CBR D & D FARMS			
105	KD46542			CBR	DONGOLA,			
106	WPWX986	136 NE FRONT ST	DONGOLA		CBR DONGOLA,			
107	WPWX986		DONGOLA		CBR DONGOLA,			
108	WPPH958		MAKANDA		CBR NOVA COM			
109	KNBZ516	SUMMIT OF WATERVALLEY RIDGE	MAKANDA		CBR NovaCom Inc			
110	KNBZ516		MAKANDA		CBR NovaCom Inc			
111	WPGY960	517 N MAIN ST	ANNA	CBR	NOVACOM			
112	WNCV237	RT 3 4 MI NW INT RT 146 & RT 3	WOLF	CBR	R M F S INC			
113	WNCV237		WOLF	CBR	R M F S INC			

ID	Name	Address	City	Class	Owner	Function	Replacement Cost
114	WNYK961	BALD KNOB MOUNTAIN 2 MI SW	ALTO	CBR	RAVE INC		
115	WNYK961		ALTO	CBR	RAVE INC		
116	KNGP229	NW 1/4 SEC 3 T11S R2W OF 3RD	ALTO	CBR	RENDLEMAN		
117	KNGP229		ALTO	CBR	RENDLEMAN		
118	WPFU607	1 MI N OF INT OF RT 127 & DONGOLA	ANNA	CBR	RICH, DON		
119	WPFU607		ANNA	CBR	RICH, DON		
120	KCT973	BALD KNOB MOUNTAIN 2 MI SW	ALTO	CBR	ROY WALKER		
121	KCT973		ALTO	CBR	ROY WALKER		
122	WPIG784	12 MI DUE W OF INT I24 I57	COBDEN	CBR	ROY WALKER		
123	WPIG784		COBDEN	CBR	ROY WALKER		
124	WPKG560	12 MI DUE W OF INT I24 I57	COBDEN	CBR	ROY WALKER		
125	WPKG560		COBDEN	CBR	ROY WALKER		
126	WPMM337	19 KM DUE W OF INT I24 I57	COBDEN	CBR	ROY WALKER		
127	WPMM337		COBDEN	CBR	ROY WALKER		
128	WPNZ346	ON SKYLINE DR APPROX 3.7KM	ALTO	CBR	ROY WALKER		
129	WPNZ346		ALTO	CBR	ROY WALKER		
130	WNZE731	4.8W OF I57 & GOREVILLE	GOREVIL	CBR	S I WASTE		
131	WNZE731		GOREVIL	CBR	S I WASTE		
132	WPRS370	NE COR ST RT 3 AND WARE WOLF	WOLF	CBR	SHAWNEE		
133	WPRS370		WOLF	CBR	SHAWNEE		
134	WPMX695	8 KM NE OF SPRINGVILLE	DONGOLA		CBR	SOUTH WATER	
135	WPMX695	0.1 KM OF SR 127 & CR 12	DONGOLA		CBR	SOUTH WATER	
136	WPMX696	5.1 KM NW FROM DONGOLA	DONGOLA		CBR	SOUTH WATER	

ID	Name	Address	City	Class	Owner	Function	Replacement Cost	137
KNNI835		CBR	SO IL FOODS INC					
138	KOL260	1.6 KM N ON HWY 51	DONGOLA		CBR	SO IL ELECTRIC		
139	WPCS947			CBR		SO IL ELECTRIC		
140	WIA549	US RT 51 N	DONGOLA		CBR	SO IL ELECTRIC		
141	WPEB274	1.4 MI NW OF ANNA	JONESB	CBR		SO IL ELECTRIC		
142	WPUX898	US RT 51, N of	DONGOLA		CBR	SO IL ELECTRIC		
143	WQGB453	Dongola Site, US Route 51 N	Dongola	CBR		So IL Power Coop		
144	WQII850	US Route 51, North of	Dongola	CBR		So IL Power Coop		
145	KNKN506	1.75 MILES SOUTH OF	ANNA	CBR		So IL RSA		
146	WNZU563			CBR		IL, Dept of		
147	WPRU366	970 Giant City Park Road	Cobden	CBR		IL, Dept of		
148	KBJ297	TEXAS E COMPRESSOR STATION 10	ANNA	CBR		TEXAS EASTERN		
149	KNHZ473	414 EAST DAVIE STREET	ANNA	CBR		TRANSCRAFT		
150	WNGM243	.4 MI N OF UNION ALEXANDER CTY	MCCLURE		CBR	UNION PACIFIC		
151	WNKH642	MP 104.7 CHE SUB 2200 SSE	WARE	CBR		UNION PACIFIC		
152	KNNJ353	309 W MARKET ST	JONESB	CBR		UNION, COUNTY		
153	KNNJ353	7420 US HWY 51 S	DONGOLA		CBR	UNION, COUNTY		
154	KNNJ353	310 US HWY 51 N	DONGOLA		CBR	UNION, COUNTY		
155	KNNJ353	4665 STATE RTE 3 N	WOLF	CBR		UNION, COUNTY		
156	KNNJ353	SKYLINE DR APPROX 4KM SE OF	ALTO	CBR		UNION, COUNTY		
157	KNNJ353	125 W DAVIE ST	ANNA	CBR		UNION, COUNTY		
158	KNNJ353		JONESB	CBR		UNION, COUNTY		
159	KXK941	309 W MARKET ST	JONESB	CBR		UNION, COUNTY		

ID	Name	Address	City	Class	Owner	Function	Replacement Cost
160	KXK941		JONESB	CBR	UNION, COUNTY		
161	WNAK274	304 W MISSISSIPPI ST	JONESB	CBR	UNION, COUNTY		
162	WNXK949	309 W MARKET ST	JONESB	CBR	UNION, COUNTY		
163	WNXK949		JONESB	CBR	UNION, COUNTY		
164	WPAK374	311 W MARKET ST	JONESB	CBR	UNION, COUNTY		
165	WPAK374	7420 US HWY 51 S	DONGOLA		CBR	UNION, COUNTY	
166	WPAK374	4 KM SE OF ALTO PASS ON SKYLINE	ALTO	CBR	UNION, COUNTY		
167	WPAK374		JONESB	CBR	UNION, COUNTY		
168	WPKH623	100 1/2 W MARKET ST	JONESB	CBR	UNION, COUNTY		
169	WPKH623	4665 ST RT 3 N	WOLF	CBR	UNION, COUNTY		
170	WPKH623	201 N APPLEKNOCKER ST	COBDEN	CBR	UNION, COUNTY		
171	WPKH623	135 E PINE ST	ALTO	CBR	UNION, COUNTY		
172	WPKH623		JONESB	CBR	UNION, COUNTY		
173	WPKH623	310 US HWY 51 N	DONGOLA		CBR	UNION, COUNTY	
174	WPKH623	101 MARKET STREET	ANNA	CBR	UNION, COUNTY		
175	WPKH639	309 W MARKET ST	JONESB	CBR	UNION, COUNTY		
176	WPKH639		JONESB	CBR	UNION, COUNTY		
177	WPMD528	311 W MARKET ST	JONESB	CBR	UNION, COUNTY		
178	WPPZ707	309 W MARKET ST	JONESB	CBR	UNION, COUNTY		
179	WPPZ707	310 US HIGHWAY 51 N	DONGOLA		CBR	UNION, COUNTY	
180	WXP438	131 HILLSIDE TER	ANNA	CBR	UNION, COUNTY		
181	WXP438		ANNA	CBR	UNION, COUNTY		
182	WLI216	WRAJ-AM TOWER	ANNA	CBR	W. RUSSELL		

ID	Name	Address	City	Class	Owner	Function	Replacement Cost
183	WPNF823	202 NORTH MAIN ST	ANNA	CBR	W. RUSSELL		
184	KNHT649	APPROX 1MI NW OF BALD KNOB	ALTO	CBR	WALKER, ROY L		
185	KNHT649		ALTO	CBR	WALKER, ROY L		
186	WPAQ753	BALD KNOB MOUNTAIN 2 MI SW	ALTO	CBR	WILLIAMS AIR		
187	WPAQ753		ALTO	CBR	WILLIAMS AIR		
188	WYU344	JCT RT 3 & RT 146	WARE	CBR	WILLIAMS,		
189	KNGD581	1 MI SE	DONGOLA		CBR WILLIAMS,		
190	WNXC784	3 MI W OF I57 & GOREVILLE	GOREVIL	CBR	WILLIAMSON,		
191	WQFD417	4.8KM W OF I 57 & GOREVILLE	GOREVIL	CBR	WILLIAMSON,		
192	WQFD417		GOREVIL	CBR	WILLIAMSON,		
193	WQA903	RIDGE 4 MI NE OF COBDEN IL & 1 1/3	COBDEN	CBR	WPSD-TV, LLC		

Dams Report

ID	Name	River	City	Owner	Purpose	Height (ft)	Replacement Cost
1	DONGOLA LAKE DAM	LITTLE CREEK	DONGOLA	City of Dongola	SR	34	
2	DENNYS POND DAM	TRIB CACHE RIVER	BELKNAP	Donald Denny	P	25	
3	CHOATE LAKE DAM	KOHLER CREEK	THEBES	Illinois Department	SR	25	
4	ALTO PASS RESERVOIR DAM	CAVE CREEK	ALTO PASS-	Village of Alto Pass	S	45	
5	HINZ POND DAM	TRIB GRASSY CREEK	NO TOWN	Herbert Hinz	R	26	

EOC Facilities Report

ID	Name	Address	City	Class	Year Built	Shelter Cap	Stories	Replacement Cost*
1	Emergency Services	301 W. Mississippi St	Jonesboro	EDFLT	\$1,110			
2	Union County Sheriff's	307 W. Market St	Jonesboro	EDFLT	1927		2	\$1,110
3	Anna Police and Fire	203 E Vienna St	Anna	EDFLT				\$1,110
4	Union County 9-1-1 PSAP	307 W Market St	Jonesboro	EDFLT			2	\$1,110

* Replacement costs are in thousands of dollars

FireStation Facilities Report

ID	Name	Address	City	Class	Stories	Year Built	Replacement Cost
1	Jonesboro Fire Dept	102 W Market St	Jonesboro	EFFS			666
2	Dongola Fire Dept	310 Us 51 N	Dongola	EFFS			666
3	Alto Pass Volunteer Fire Dept	135 East Pine St	Alto Pass	FDFLT			666
4	Anna Fire Dept	102 Market St	Anna	FDFLT			666
5	Cobden Fire Dept	201 N. Appleknocker St	Cobden	FDFLT			666
6	Ware-Wolf Lake Fire Dept	4960 Illinois Rt 3 North	Wolf Lake	FDFLT			666

* Replacement costs are in thousands of dollars

Hazardous Materials

ID	Name	Address	City	Class	EPAID	Chemical Name
1	ENSIGN-BICKFORD CO.	5570 STATE RTE. 3 N.	WOLF LAKE	HDFLT	ILD982624777	LEAD COMPOUNDS
2	ENSIGN-BICKFORD CO.	5570 STATE RTE. 3 N.	WOLF LAKE	HDFLT	ILD982624777	MERCURY

Medical Care Facilities Report

ID	Name	Address	City	Class	Function	Beds	Stories	Replacement Cost
1	CHOATE MENTAL	1000 NORTH MAIN STREET	ANNA	EFHM	Hospital	105		7770
2	UNION COUNTY	517 NORTH MAIN STREET	ANNA	EFHM	Hospital	52		7770
3	City Care Center	315 S. Brady Mill Rd	ANNA	MDFLT	NursingHom			7770
4	City Care Center of	430 S. Front St	COBDEN	MDFLT	NursingHom			7770
5	Rural Health		ANNA	MDFLT	NursingHom			7770
6	Jonesboro Healthcare &	995 State Route 127 S	JONESBORO	MDFLT	NursingHom			7770
7	Holly Hill Nursing Home	203 Layfayette St	ANNA	MDFLT	NursingHom			7770
8	Mulberry Manor	612 E. Davie St	ANNA	MDFLT	NursingHom			7770
9	The Fellowship House	800 N. Main St	ANNA	MDFLT	NursingHom			7770
10	Hidden Valley Care Center	202 S. Pecan St	JONESBORO	MDFLT	NursingHom			7770
11	Illinois Veterans Home at	792 N. Main St	ANNA	MDFLT	NursingHom			7770
12	New Way Inc.	80 Knupp School Ln	ANNA	MDFLT	NursingHom			7770
13	Orchard Court	1430 State Rt 1275	JONESBORO	MDFLT	NursingHom			7770
14	Peach Tree Estates	1370 State Rt 127 S	JONESBORO	MDFLT	NursingHom			7770
15	Village Inn	114 E. Ash St	COBDEN	MDFLT	NursingHom			7770
16	Spanish Oaks Center	223 W. Vienna St	ANNA	MDFLT	NursingHom			7770
17	Lincoln Square	202 S. Main St	JONESBORO	MDFLT	NursingHom			7770
18	Chamness Care	510 Alba Ln	Cobden	MDFLT				7770

* Replacement costs are in thousands of dollars

Police Station Facilities Report

ID	Name	Address	City	Class	Stories	Shelter Cap	Year Built	Replacement Cost*
1	Cobden Police Dept	112 E Maple St	Cobden	EFPS				1554
2	Anna Police Dept	102 Market St	Anna	EFPS				1554
3	Union County Sheriff's Dept	307 W Market St	Jonesboro	EFPS				1554
4	Village of Dongola PD	136 N.E. Front St	Dongola	PDFLT				1554
5	City of Jonesboro PD	103 N. Main St	Jonesboro	PDFLT				1554

* Replacement costs are in thousands of dollars

Potable Water Facilities Report

ID	Name	Address	City	Class	Function	Stories	Year Built	Replacement Cost
1	SOUTH WATER INC. WTP	7420 US Hwy 51 S	DONGOLA					36963
2	ULLIN WTP	400 W. DAVIE	ANNA					36963
3	AltoPass Water Dist.	2800 Skyline Dr	Alto Pass		watertowe			
4	Shawnee Valley Water Dist	4720 St Rt 3 N	Wolf Lake		watertowe			
5	Cobden Village Water	100 Bainbridge St	Cobden		watertowe			
6	AnnaJonesboro Water	102 Grammer St	Jonesboro		watertowe			
7	Dongola Water Dept	105 Spring St	Dongola		watertowe			
8	AJ Water Tower	360 Baker St	Anna		watertowe			
9	AJ Water Comm	495 Water Plant Ln	Jonesboro		WTP			
10	AJ Water Comm	650 State Pond Rd	Jonesboro		WTP			
11	AJ Water Comm	1190 Old Hwy 51 N	Anna					
12	Alto Pass Watre Dist	1325 Alto Waterworks Rd	Cobden		WTP			
13	Jonesboro WTP	1880 State Rt 127 S	Jonesboro		WTP			
14	Dongola Water Tower	137 W Cross St	Dongola		watertowe			
15	Dongola WTP	4492 Lake Rd	Dongola		WTP			

School Facilities Report

ID	Name	Address	City	Class	Students	Stories	Year Built	Replacement Cost
1	ANNA JUNIOR HIGH	301 S GREEN ST	ANNA	EFS1	341			555
2	LINCOLN ELEM SCHOOL	108 WARREN ST	ANNA	EFS1	245			555
3	ANNA-JONESBORO HIGH	608 S MAIN ST	ANNA	EFS1	512			555
4	COBDEN JR HIGH SCHOOL	413 N APPLEKNOCKER	COBDEN	EFS1	111			555
5	COBDEN HIGH SCHOOL	413 N APPLEKNOCKER	COBDEN	EFS1	196			555
6	COBDEN ELEM SCHOOL	409 N APPLEKNOCKER	COBDEN	EFS1	427			555
7	Shawnee Jr-Sr High	3365 State Rt 3 N	WOLF LAKE	EFS1				555
8	Dongola Elementary-High	1000 High St	DONGOLA	EFS1				555
9	JONESBORO ELEM	309 Cook Ave	JONESBORO	EFS1	492			555
10	Shawnee Community College	1000 N Main St	Anna	SDFLT				555
11	Lick Creek School	7355 Lick Creek Rd	Lick Creek	SDFLT				555
12	Union Co Pre-K	305 Cook Ave	Jonesboro	SDFLT				555
13	Tri-County School	1000 N Main St	Anna	SDFLT				555
14	Lick Creek Pre-K	7355 Lick Creek Rd	Lick Creek	SDFLT				555
15	Anna Pre-K	108 Warren St	Anna	SDFLT				555
16	Dongola Pre-K	1000 High St	Dongola	SDFLT				555
17	Cobden Pre-K	413 N Appleknocker St	Cobden	SDFLT				555
18	Wolf Lake Pre-K	4720 State Rt 3 N	Wolf Lake	SDFLT				555

* Replacement costs are in thousands of dollars

Waste Water Facilities Report

ID	Name	Address	City	Function	Class	Stories	Year Built	Replacement Cost
1	ANNA STP	1020 N Lime Kiln Rd	ANNA		WDF			73926
2	COBDEN STP	502 S JEFFERSON St	COBDEN		WDF			73926
3	JONESBORO STP	1880 State Rt 127 S	JONESBORO		WDF			73926
4	WARE SANITARY		Jonesboro		WDF			73926
5	WOLF LAKE SAN	168 West St	WOLF LAKE		WDF			73926

* Replacement costs are in thousands of dollars

Appendix G: Critical Facilities Maps

Please See PDF Files on Disk or Attached Maps

Appendix H - NOAA Flood Data: USGS Stream Gauge Data

County	Union County		Alexander County	
Station	Jonesboro, IL		Thebes, IL	
River	Green Creek Tributary		Mississippi River	
Period of Record	1956-1980		1933-2008	
Latitude	37.46528		37.2164722	
Longitude	89.31111		89.4675833	
Rank	Year	Discharge (cfs)	Year	Discharge (cfs)
1	1965	605	1844	1,075,000
2	1974	526	1993	996,000
3	1977	521	1943	893,000
4	1973	439	1973	886,000
5	1958	425	1995	875,000
6	1966	418	1983	846,000
7	1970	409	2002	838,000
8	1963	380	1947	837,000
9	1972	364	1944	812,000
10	1957	329	1951	805,000

County	Alexander County		Cape Girardeau County	
Station	Thebes, IL		Cape Girardeau, MO	
River	Mississippi River		Mississippi River	
Period of Record	1844-2009		1943-2009	
Latitude	37.21700		37.30200	
Longitude	89.46400		89.51800	
Rank	Date	Historical Crests (ft)	Date	Historical Crests (ft)
1	05/23/1995	45.91	08/08/1993	48.49
2	08/07/1993	45.51	05/24/1995	47.00
3	07/04/1844	45.15	08/03/1993	46.90
4	05/18/2002	44.31	05/18/2002	45.70
5	04/30/1973	43.43	05/01/1973	45.50
6	10/14/1987	41.52	04/17/1979	44.10
7	07/03/2008	40.95	05/27/1943	42.40
8	10/02/1993	40.82	07/03/2008	42.35
9	03/01/1985	40.46	07/05/1947	41.90
10	03/24/2008	40.37	06/24/2008	41.37